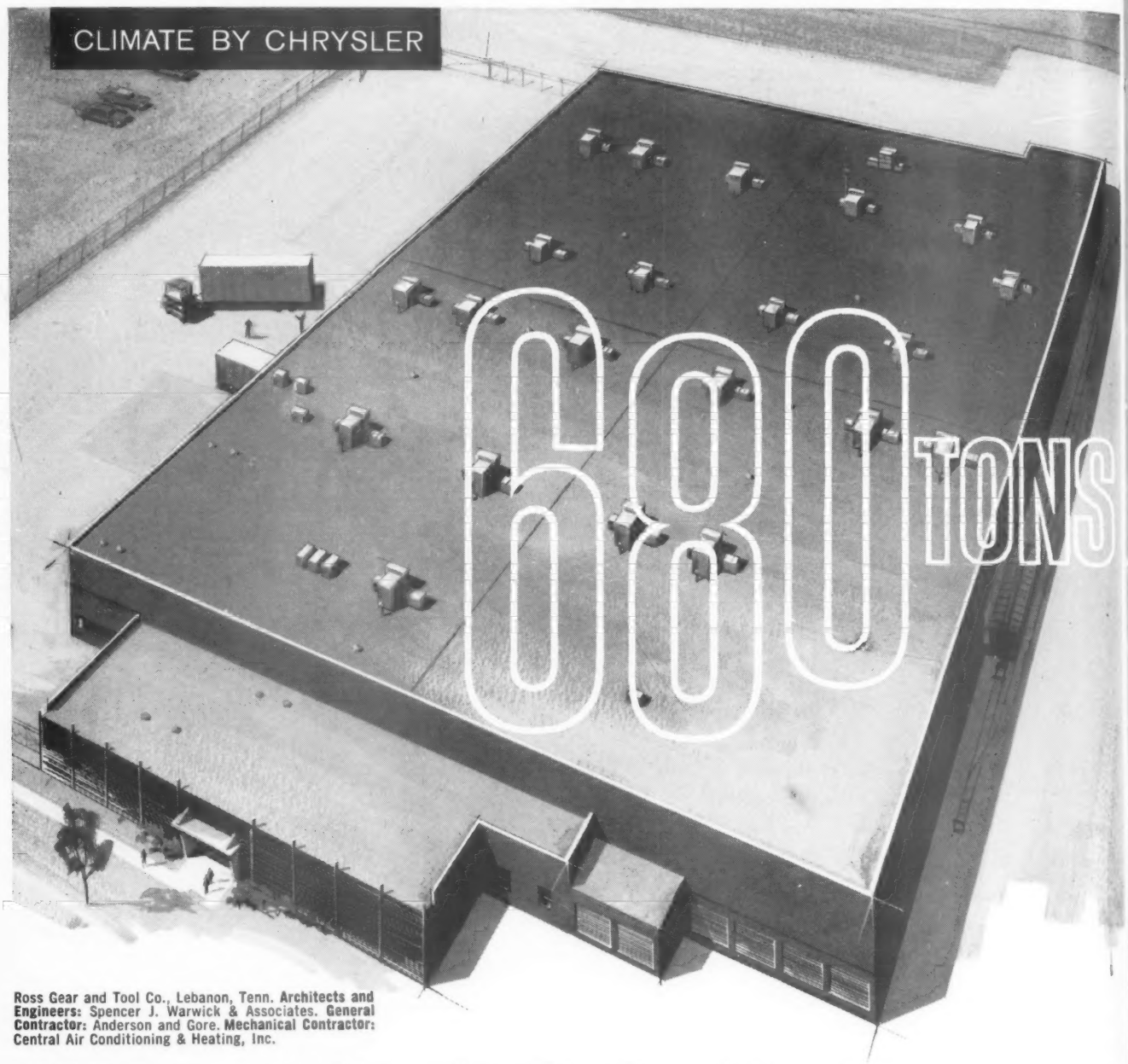
AIR ENGINEERING

NOVEMBER, 1961
VOL. 3, NO. 11

AIR QUALITY CONTROL . . . FOR COMFORT, PROCESS AND PROFIT

- Health Hazards Of Beryllium Machining p. 30
- Flexonics' Clean Rooms Designed Against Obsolescence p. 33
- How B&L's Super-Precise Cooling Holds to ±.01°F. p. 36
- 1st Annual Directory Of Clean Room Supplies and Equipment p. 43



Ross Gear and Tool Co., Lebanon, Tenn. Architects and Engineers: Spencer J. Warwick & Associates. General Contractor: Anderson and Gore. Mechanical Contractor: Central Air Conditioning & Heating, Inc.

680 tons of Chrysler Air Conditioning on the roof save 1100 sq. ft. of valuable floor space inside

Sprouting from the roof of this new plant for Ross Gear and Tool Company are 22 Chrysler 30-ton packaged air conditioning units. Together with two Chrysler packaged liquid chillers and four split-system units, they provide the cooling (785 tons of it!) for almost five acres of manufacturing and office space.

By putting 680 tons of Chrysler Air Conditioning *on* the roof, instead of *under* it, the company freed 1100 sq. ft. of valuable floor space for other jobs. And by installing these units zone-by-zone during construction, the company saved money by starting operations in part of the building while the rest was being completed.

The cooling load is spread over 28 different Chrysler units, ranging from a 4-ton condensing unit to a 45-ton chiller. Thus, varying departmental load requirements can be handled with ease. There is no fixed operating cost, as there would be with a conventional single-unit installation.

Whether your job calls for air-cooled or water-cooled equipment . . . packaged units or chillers . . . you'll find the complete Chrysler line has the exact unit you need. For complete data, or the technical cooperation of a Chrysler Engineer, write today.

CHRYSLER
AIRTEMP
A Division of Chrysler Corporation
Dept. H-111, Dayton 4, Ohio

[For more information circle #11 on page 61 reply cards]

AIR ENGINEERING

VOL. 3, NO. 11

NOVEMBER, 1961

AIR QUALITY CONTROL . . . FOR COMFORT, PROCESS, PROFIT

FEATURES

- **Health Hazards Of Beryllium Machining** 30
  by Jan Lieben, M.D., National Health Council. How beryllium illness can spread throughout an area around a plant in which this metal is processed.
- **How To Collect Beryllium Dust** 32
  Short article on dust collection from beryllium machining processes.
- **New Flexonics Clean Room Beats Obsolescence** 33
  by S. H. Bokemeier, Chief, Quality Control, Flexonics Corp.
- **Temperature Control to ± .01°F At Bausch & Lomb** 36
  by Michael Pena, plant engineering dept., Bausch & Lomb. Ruling engines that cut parallel lines in optical glass to an accuracy of five millionths of an inch for diffraction gratings, must do so in precisely controlled thermal environment.
- **Ventilation Design For Transfer Of Liquid Materials** 42
  by William V. Andresen, chief industrial hygienist, American Cyanamid Co. Hood and enclosure design for pump glands, suction lift and other methods of liquid transfer, to protect employees from toxic fumes and gases.
- **First Annual Directory of Contamination Control Equipment** 47
  List of over 200 manufacturers of equipment and supplies for white rooms, superclean rooms and areas, by type of equipment and name and address of firm.

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COVER

Cover shows clean room at Flexonics Corporation's new clean room facility which is designed to defeat the obsolescence factor that looms over this fast changing field of contamination control. Story on p. 33.

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AAF cleans, heats, moves a

A battery of AAF dry-type dust collectors exhausting grinding operations. After-cleaners on collectors provide for re-circulation of cleaned air.

AAF packaged central station air handling units, suspended from the ceiling in the warehouse, save valuable space, provide quiet operation.

AAF

AIR CLEANING PRODUCTS
Air Filters
Dust Collectors

AIR CONDITIONING, HEATING & VENTILATING PRODUCTS

AAF electronic air cleaners provide clean air for the Maytag Headquarters Building, Newton, Iowa. Architects: Brooks-Borg, Des Moines. Air Conditioning Engineer: William Nanes, Des Moines.

COMPLETELY CONDITIONED AIR

...o make it work for Maytag

Multi-product installation demonstrates AAF's capability for complete air engineering

THE manufacture of major appliances demands that air be put to work in many different ways. Here are the jobs it had to do at the Maytag office and plants in Newton, Iowa: (1) help keep the interior of the impressive new headquarters building perpetually clean, (2) control dust from grinding operations, (3) provide heating and ventilating for the warehouse and service repair area, (4) control dust from polishing operations, (5) provide proper exhaust from plant and processing operations, and (6) help provide a dust-free atmosphere in the enameling department.

AAF is the only company that provides *all* the major components for *completely* conditioned air. Just as important, AAF offers the knowledge and experience to coordinate the functioning of these components into one integrated system.

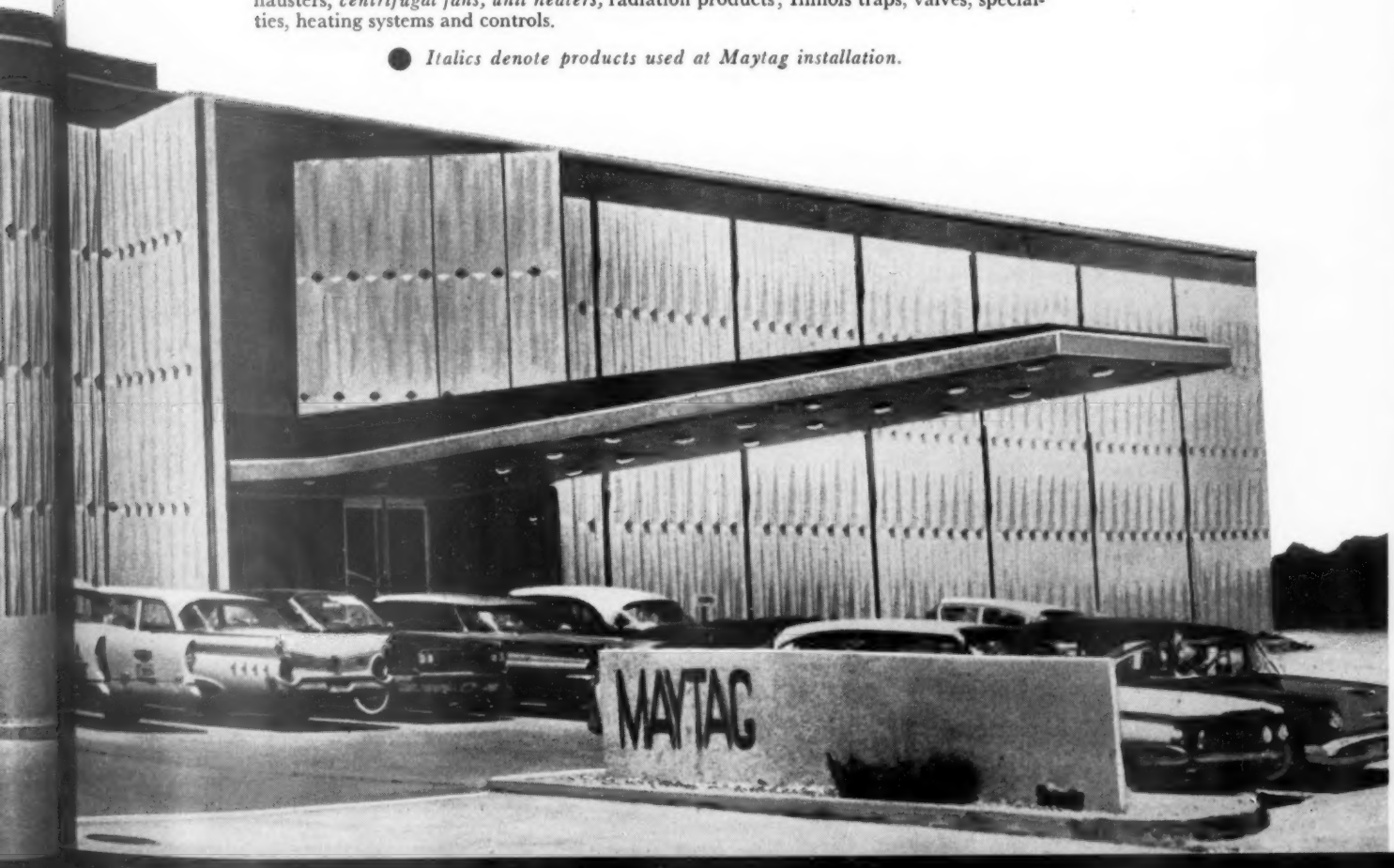
If air must do many jobs in the building you are planning, talk with AAF. Booklet 518 describes the complete line of AAF component products. If you would like a free copy, address Richard W. Smith, American Air Filter Company, Inc., 305 Central Ave., Louisville, Ky. In Canada: American Air Filter of Canada, Ltd., 400 Stinson Blvd., Montreal 9.

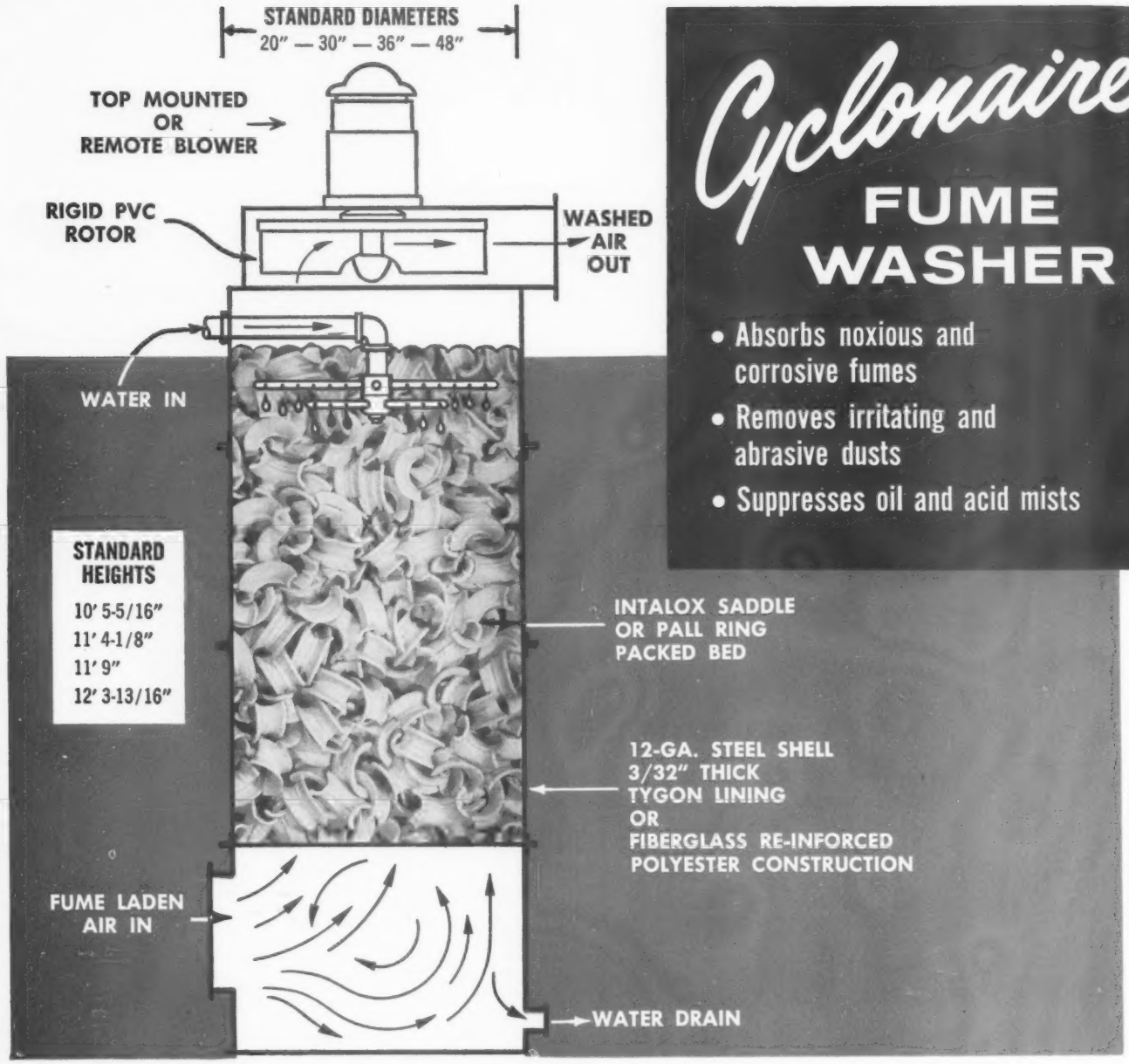
AAF **American Air Filter**

BETTER AIR IS OUR BUSINESS

AIR CLEANING: (Atmospheric Dust) *AAF electronic air cleaners, automatic air filters, unit filters,* engine & compressor filters. (Process Dust) electrostatic precipitators, *wet-type collectors, dry-type collectors,* fabric arresters. AIR CONDITIONING, HEATING & VENTILATING: Herman Nelson air conditioning unit ventilators, unit ventilators, portable heaters; Kennard/Nelson dual-duct air conditioning units, multi-zone air conditioning units, *packaged central station air handling units,* sprayed-coil dehumidifiers, fan-coil units, packaged liquid chillers, cooling towers, evaporative condensers, direct-expansion coils, water coils, steam coils, *unit blowers,* industrial exhausters, *centrifugal fans, unit heaters,* radiation products; Illinois traps, valves, specialties, heating systems and controls.

● *Italics denote products used at Maytag installation.*





Cyclonaire FUME WASHER

- Absorbs noxious and corrosive fumes
- Removes irritating and abrasive dusts
- Suppresses oil and acid mists

The "Cyclonaire" is a surprisingly compact wet bed scrubber. It will fit almost anywhere, but it does a fume removal job formerly possible only with expensive custom-designed units. Removal of many gases (of 1% concentration or less) is up to 99% effective. Low power requirements make it very economical to operate.

The "Cyclonaire" is available fabricated either from 12-gauge steel, lined with 3/32" thick Tygon sheet plastic, or from fiberglass re-inforced polyester resin. The lined-steel unit comes complete with a top-mounted blower equipped with a rigid polyvinyl chloride (PVC) rotor. The lighter weight fiberglass re-inforced polyester unit utilizes a separately mounted blower duct-connected to the unit.

Both units are shipped complete with the necessary packing — Intalox porcelain saddles, metal or poly propylene Pall Rings—depending upon the corrosive conditions or weight limitations existing.

The "Cyclonaire" is available in four sizes with rated capacities of 750, 1650, 3500 and 6000 cfm.

Its low initial cost, its low operating cost, its high efficiency make the "Cyclonaire" a logical choice for a wide range of fume scrubbing operations. Full technical data in Bulletin FW-10R. Write for it today.

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AKRON 9, OHIO

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[For more information circle #15 on page 61 reply cards]

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EDITORIAL:

It Takes Engineered Air To Get To The Moon!

THE RACE TO THE MOON has implications important to all of us in this business of the engineering of air for comfort and process.

The Administration's avowed intention to plunge some $40-billion into moon race and missile development means expansion of engineering and manufacturing facilities in the electronics, chemical, metallurgical and other space-related industries.

Even more important, space-race-born techniques will find "civvy" applications in manufacture of consumer goods and so bring benefits to many other industries.

The same methods used to control air contamination for final assembly of the extremely dust-sensitive innards of guided missile gyros, are being eagerly grasped by other industries who have long had contamination problems but didn't know there was a solution until now.

Like the cheese business, man.

A cheese firm in Pennsylvania had been plagued with alien bugs, germs or whatever form of life is used to "ripen" cheese. Super-fine filters, spawned by the space age, were used to keep out those "pore spores."

The pill-rolling industry (like pharmaceutical plants) have similar problems of microscopic bugs and chemicals contaminating their products.

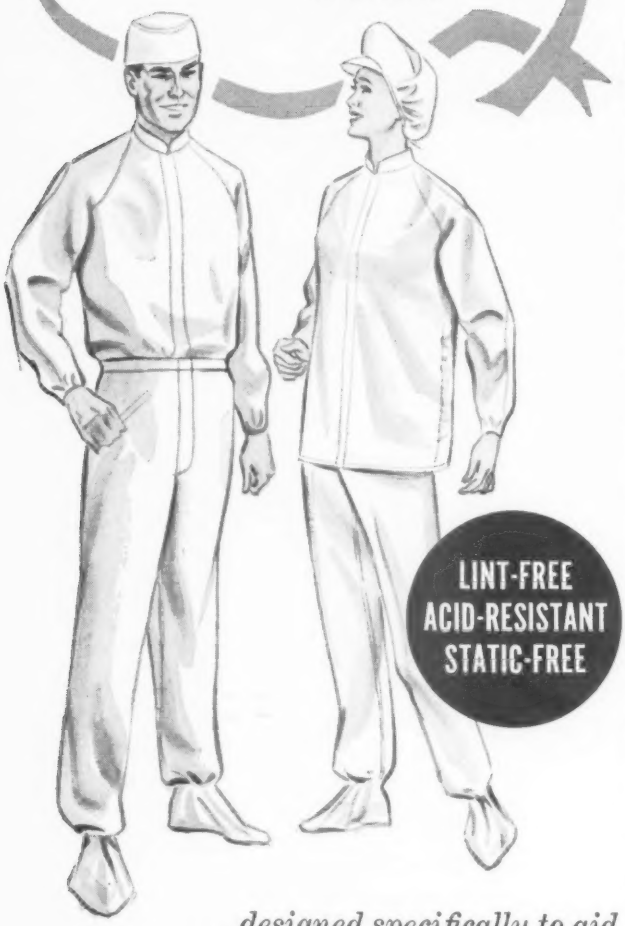
A contact lens firm in New York grind their lenses with an abrasive dust that winds up on the highly polished finished job with disastrous results. From AIR ENGINEERING this firm learned that techniques are available that can keep this harmful dust from finished lenses, so now they are building a new plant that will be completely air conditioned and free of dust.

TV tube manufacturers have taken a tip from space scientists and have installed elaborate air conditioning and air filtration systems in their plants purely for product quality purposes.

(Please turn to page 68)

SHANE

INDUSTRIAL APPAREL FOR MEN AND WOMEN



LINT-FREE
ACID-RESISTANT
STATIC-FREE

. . . designed specifically to aid precise "clean air" control in "white rooms" and standard environments!

The many styles in the new line of industrial apparel manufactured by Shane were designed to meet the operating requirements of a wide range of industries engaged in precise, controlled assembly and production. Choose from slack-shirt jacket ensembles such as illustrated, shirt and trouser combinations, lab frocks and dresses . . . in Dacron, Dacron-Rayon and Nylon. Compatible accessories for complete protective covering also available.

SEND TODAY for newly released folder illustrating and describing the complete Shane line of Industrial Apparel for men and women.

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REPRESENTATIVES COAST TO COAST

deluxe uniforms Shane

[For more information circle #16 on page 61 reply cards]

HERE'S THE ONLY PORTABLE VACUUM

FOR EFFECTIVE, PRACTICAL, LOW-COST CONTROL OF CLEAN ROOM DUST!

Meets the control standards for all classes of Clean Rooms, Computer Rooms . . . or wherever high efficiency dust control is required during the physical cleaning process.

HIGH EFFICIENCY FILTER SYSTEM — Microstatic® Impaction Filter removes dust and bacteria down to 0.3 micron particle size.

SPECIAL OUTBOARD FILTER — effectively traps carbon dust particles produced by the wear of motor brushes. Only Microstat's non-by-pass motor design permits control of this potential source of contamination.

DIFFUSED EXHAUST — eliminates the possibility of exhaust air disturbing dust from uncleaned areas.

WET AND DRY PICK-UP — low-cost Microstat® does both jobs quickly, thoroughly — a big advantage over expensive central systems.

Write today for full information.
The Kent Company, Inc., Rome, N.Y.

KENT

MICROSTAT®
CLEAN ROOM VACUUM

®T.M. The Kent Company, Inc. • Rome, New York

[For more information circle #45 on page 61 reply cards]

NEWS

Federal VS Private Engineers

The government gains seven ways by using private consulting engineers, rather than by employing such engineering talent on a salary basis, according to Harold P. King, president of the Consulting Engineers Council.

King is a partner in the consulting firm of King, Benioff & Associates, Sherman Oaks, Calif.

Advantages cited by King include:

1. Preservation of private enterprise.
2. Enhanced national security by building up corps of private engineering firms with whom the armed forces are familiar.
3. Greater choice of specialists who have won their spurs in the competition of private practice.
4. More efficient performance from engineers used to pressure of private practice.
5. Minimum size of government staffs; deterrent to over-expansion.
6. Accurate and complete cost records.
7. Economy.

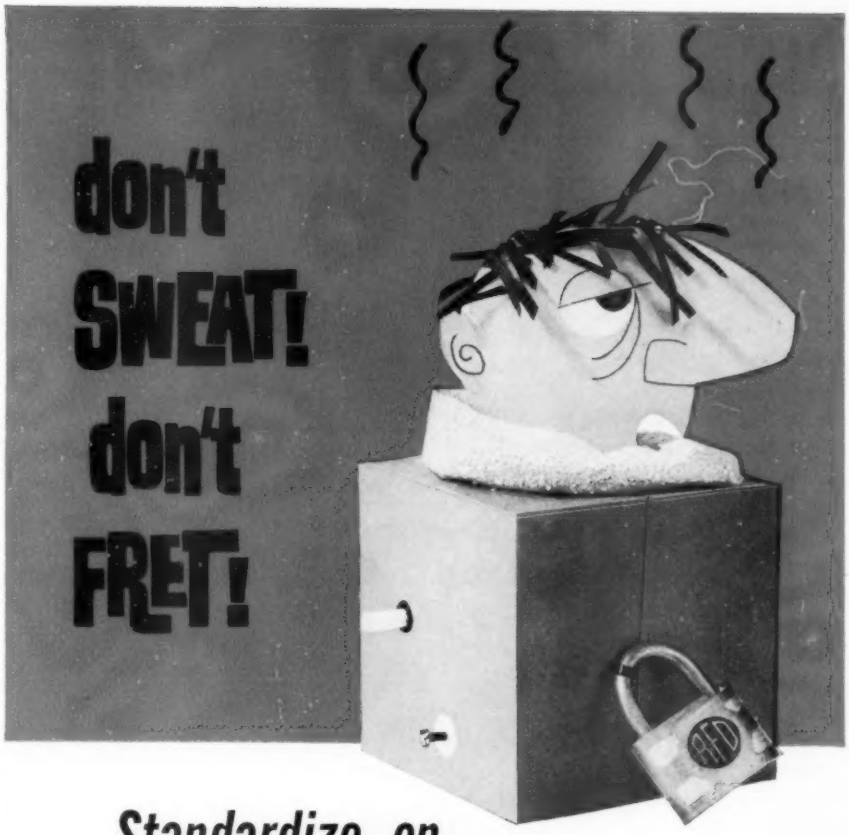
A Peek At Peking Cooling

Workers in the Chunking Iron and Steel Works, located on the steamy banks of the Yangtse River, are now cooler than ever before, according to the Peking Review, a weekly magazine published by Communist China.

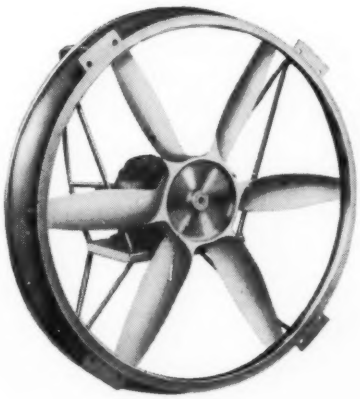
Says the Peking Review: ". . . a continuous current of cool air comes to them from electric fans and a welcome drizzle falls from a high speed (water?) sprayer installed in their shop. In addition, some steel plants have 'water curtains' to absorb heat radiated from the furnaces, as well as air conditioners and asbestos heat shields."

(Please turn to following page)

Use the Communications Center, page 61, to receive more information about any product advertised.



Standardize on
HARTZELL PROPELLER FANS
for low cost,
high efficiency industrial ventilation



All Hartzell fans are designed and built specifically for the punishing demands of heavy industrial service. All feature cast aluminum alloy propellers and the exclusive Hartzell curved orifice Air Seal ring which eliminates turbulence and backflow of air at the propeller tips. Standard propellers in sizes from 12" to 60" plus special Lo-Noise, high pressure and reversible propellers. All can be furnished in standard direct-connected, ring-mounted models, in panel or duct section mountings, or in special belt-drive, pulley-drive or extension-shaft construction.

For complete details, just give your nearby Hartzell field engineer a call. You'll find him listed in the Yellow Pages or in the Hartzell catalog in Sweet's Plant Engineering and Industrial Construction Files.

Hartzell PROPELLER FAN COMPANY
Division of Castle Hills Corp. • PIQUA, OHIO
HARTZELL
A Member of AMCA

[For more information circle #19 on page 61 reply cards]

NEWS of the Industry . . .

(Continued from preceding page)

CITIES DRIVE TO MEASURE AND CONTROL AIR POLLUTION

Denver, Colo.—A two-day course on air pollution taken by Denver businessmen and health officials covered the health aspects of pollution in Denver. Dr. Wm. Spence, pulmonary disease specialist at University of Colorado School of Medicine, reported that a study of 172 Denver bank employees revealed that 42% or 24 of them showed symptoms of respiratory disease. All but two were heavy smokers. In another study of 194 medical students, 11% or 21 had respiratory disorder symptoms.

Drawing a distinction between what he termed "general air pollution," the air we breathe, and "personal air pollution" or smoking, Dr. Spence said that the evidence is overwhelming that industry-created dirty air contributes to respiratory ailments, and that smoking contributes to lung cancer.

Also in Denver, a $5000 grant from a private foundation was made to the Department of Atmospheric Sciences of Colorado State University, to study Denver air pollution.

A Denver voluntary group of business and professional people have also initiated, on their own, continuing studies to determine the source and extent of and solutions to Denver's pollution problem.

Newark, N. J.—In Newark, and in 34 other cities throughout New Jersey, air sampling instruments have begun an intensive study of air pollution in the state. The survey is being carried out by the New Jersey Health Department.

Washington, D. C. — The U.S. Senate extended, by voice vote, the 1955 Air Pollution Research Act from 1964 to 1966, and in addition continued the authorization of the annual $5-million appropriation to the U.S. Public Health Service and other agencies to finance air pollution research. Bill is now in the House, where it will stay until next session.

Cleveland, Ohio—The Council of the city of Cleveland, in the person of Councilman Ernest Santora, has called for a progress report on the city's anti-air pollution efforts. Air pollution control commissioner Albert Locuoca has reportedly said that all that can be done is being done at this time, and during the past eight years area industry has spent over $35-million for control equipment.

New York City — According to the New York City Air Pollution Control Department, New York's Mayor Robert F. Wagner has announced a program of action designed to reduce pollution over the city. The Mayor has proposed that: Open fire burning of demolition and building site debris be banned; all new incinerators be designed to eliminate air pollution; that 12,000 existing incinerators be modernized to reduce air pollution; that industry expedite measures to cut down pollution from factory smoke stacks; that Federal Aviation Agency take action to stop air pollution from jet planes.

D. C. Building Boom

Office space has about disappeared in Washington, D. C., and so according to the Washington Real Estate Board, another commercial building boom is about to begin in the nation's capitol.

Buildings now planned total between 500,000 and 1-million sq. ft.

(Please turn to page 14)

To receive information on any of the New Products, circle the item reference number on the postage-free reply cards on page 61, Communications Center.

for dust-free control in any room!

BARONN'S LINT FREE FOOT COVER WILL HELP YOU CONTROL CONTAMINATION IN YOUR WHITE ROOM AREA.
THIS HAS BEEN PROVEN BY EXTENSIVE USE IN EXISTING WHITE ROOMS.

- Baronn's foot cover is made of 100% Nylon, Anti Static, lint free materials
- Covers entire shoe—lessens the need for an expensive shoe cleaner
- Cooler—gives operator ventilation for maximum foot comfort
- Absorbs dust present on floor, a constant cleaning aid
- Retains dust and lint on operators shoe
- Long life—due to hard sole
- Foot cover is repairable
- Pre-packaged 10 pair per polyethylene bag

Sizes: Medium, Large and Extra Large

WE INVITE YOUR INQUIRY ON OUR LINE OF LINT FREE CLOTHING!

baronn's PROFESSIONAL APPAREL
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[For more information circle #17 on page 61 reply cards]

Oil burners in California... and coal burners in New Jersey...agree:

Electrostatic Precipitators catch fly ash at Sewaren steam power plant

When DUST is your problem— CLEAR IT WITH WP

For an efficient, economical solution to any dust control problem—look to Western Precipitation. WP is uniquely fitted to handle your unique problem—being the one organization that custom designs, engineers and installs ALL types of dust and fume control equipment: Precipitator, Mechanical, Jet-Cleaned Filter, Hi-Temp Filter, scrubbers and engineered combinations.

With no axes to grind for any one system, WP engineers will give your job a completely unbiased recommendation—whether it's a quote on your specifications, a single component, or a completely engineered installation... small, major, simple, or complex.

An inquiry—on your business letterhead—will bring you literature promptly. Just write Western Precipitation, 1000 W. 9th St., Los Angeles 54, Calif. (In Canada, write 8285 Mountain Sights Ave., Montreal, P.Q.)

Dust and fume control since 1907

[Circle #62 on page 61]

Los Angeles 54 • New York 7 • Chicago 2 • Pittsburgh 22 • Atlanta 5 • San Francisco 4

Division of Joy Manufacturing Company

ELECTROSTATIC Precipitators
MULTICLONE Collectors
CMP Combination Units
DUALAIRE Jet-Cleaned Filters
THERM-O-FLEX Hi Temp Filters
TURBULAIRE Scrubbers
JOY-MICRODYNE Scrubbers
also: **HOLO-FLITE** Processors
HI-TURBIANT Heaters
TURBULEX Calciners

NEWS of the Industry . . .

(Continued from page 12)

HOW AIR POLLUTION AFFECTS HEALTH SUBJECT OF LARGE SCALE STUDY

A large-scale animal study designed to study the possible effects of air pollution on human health will be undertaken at the Wayne State University College of Medicine in Detroit, Luther L. Terry, Surgeon General of the U. S. Public Health Service, announced recently.

Under a $190,000 Public Health Service contract, researchers at Wayne State will study more than 4,000 experimental animals with particular emphasis on pulmonary function, length of life, blood studies, and pulmonary pathology. The animals will be divided into three groups, the first of which will breathe exhaust-contaminated air pulled in directly from a heavily traveled street through a large duct especially constructed for the study. The second group will be exposed to the normal urban air present in the laboratory. The third group will be housed in a room containing specially cleansed air, from which almost all impurities will have been removed.

Among the common air pollutants which will be measured continuously, using automatic electronic instruments, are carbon monoxide, total hydrocarbons, oxides of nitrogen, total oxidants, sulfur dioxide, carbon dioxide, and inorganic particulates.

Many of the animals will be kept under study during their entire lifetimes; others will be sacrified to permit studies of tissue structure in lungs and other organs.

Additional studies will involve human subjects exposed to conditions comparable with those of the animals.

Judge Strikes Blow For Pollution

A charge against Republic Steel Corp. alleging air pollution from stacks of its new steel-making process was dismissed by Chicago Municipal Judge Joseph Geary.

The judge ruled that the Chicago plant did not emit "smoke" as smoke is defined by the Chicago air pollution ordinance, since the emissions consisted of particles of an iron compound.

"SCIENTIFIC AMERICAN" SUMMARIZES GAS CLEANING

An excellent article by Walsh McDermott in the October issue of Scientific American discusses air pollution, the scope of the problem in our urban areas and health aspects of polluted air.

Mr. McDermott has performed a genuine service for all concerned with the urgency of the air pollution problem, by his scholarly and interesting treatment of the subject. Mr. McDermott is Livingston Farrand Professor of Public Health and Preventive Medicine at Cornell University Medical College.

County Officials Vote Against Smog

Two thousand delegates to the annual conference of National Association of County Officials adopted a set of anti-air pollution policies. Recommended were: Federal legislation for more research and assistance; rapid tax write-off for control equipment; more inclusive legislation at the state level for county-wide administration of air pollution control programs.

(Please turn to page 16)

To receive information on any of the New Products, circle the item reference number on the postage-free reply cards on page 61, Communications Center.

RECORDS TOXIC GASES AND DUST

LOW COST **PHOTOTAPE SAMPLER**

AUTOMATICALLY SAMPLES EVALUATES RECORDS INSTANTLY MONITORS & RECORDS DUST AND GAS CONCENTRATION WITHOUT OPERATOR ATTENTION

The Phototape Sampler automatically collects samples on paper tape and then evaluates and permanently records concentration of dust on a strip chart. Also ideal for determining chlorine, phosgene, hydrogen sulfide, and many other gases. Principle of measurement is based on decrease of light transmission through the paper resulting from accumulation of contaminant on the sample spot.

SAVES HOURS OF LABOR, PAYS FOR ITSELF! Completely eliminates manual collection and reading of sampled tapes. Eliminates calculations ordinarily required to establish time of sample.

THE RECORDING UNIT contains an amplifier and chart recorder. Photocell readings are fed to Recording Photodensitometer Unit which provides immediate monitoring of samples plus a permanent, continuous 31 day record in values of dust or gas concentration related to the hour of day printed on the chart paper.

#B-23008 Phototape Sampler with single timer, 110V 60C $657.00

#B-23108 Phototape Sampler with dual timer, 110V 60C $697.00

(for 230V 50C models add $35.00)

Send for free catalogs of our complete line of Sampling Equipment, Radiation Detectors, Polypore Membrane Filters, Filtration Apparatus, Laboratory Instruments, and Meteorological Devices.

GELMAN INSTRUMENT COMPANY P.O. Box 118-G . . . Chelsea, Michigan

[For more information circle #55 on page 61 reply cards]

new "L" and "T" formations

Philco Plug-in Controlled Atmosphere Modules Install Quickly in Formations to Suit any Production Floor Plan.

■ An industrial engineer's dream of efficient layout . . . a drybox operator's wish for comfortable, unobstructed working area . . . both a quality control engineer's and a design engineer's highest standards of atmosphere control . . . all become realities in Philco plug-in controlled atmosphere modules. ■ Philco dryboxes, vacuum ovens and dust shields "plug" into each other in desired configurations. Fast, simplified external coupling insures higher internal hermetic reliability and leaves working areas free from obstructions. Consistent performance characteristics include drybox anhydrous conditions of less than 3 parts per million, uniform ovenwide vacuum bakeout temperature of 350° C, and oven vacuum as high as 10^{-5} millimeters of mercury. ■ Have Philco custom-engineer industry's highest standard of controlled atmosphere to your specific requirements. You'll find the value outstanding. From original consultation to operation in your plant, the Philco quoted price will not change—including original factory service. ■ For immediate consultation, without obligation, write Dept. AE1161.

Equipment Development and Manufacturing Operation

PHILCO®

Famous for Quality the World Over

LANSDALE DIVISION • LANSDALE, PENNSYLVANIA

[For more information circle #21 on page 61 reply cards]

HOW DWYER GAGES HELP INSURE RELIABLE CONTROL OF "WHITE ROOM" AIR SYSTEMS

To obtain and maintain maximum dust-free conditions in today's white rooms, precise and constant control of pressure as well as humidity, temperature and contaminants is required. It is in the areas of pressure control and filter operating efficiency that Dwyer Instruments play such a vital part.

Quick, Visual Air Pressure Readings

Dust controlled areas almost without exception are pressurized so that air "leakage" is outward. In many operations, this leakage must consist of highly accurate pressure drops between different rooms. Thus, highest pressures will be maintained in inner rooms — with progressive drops to outer rooms having lower or even atmospheric pressures. Dwyer Magnehelic Gages have proved ideal for giving extremely accurate, individual room and air pressure readings at a glance. The easy-to-read pointer type dial registers from 0" to .50" of water in .01" divisions. The magnetic linkage is frictionless and inertia-free, providing years of maintenance-free service. Equally suitable are the Dwyer Model No. 25 Manometers and Model No. 215 Stationary Inclined Gages.

Automatic Air Pressure Monitoring

As a further safeguard, Dwyer Differential Pressure Switches can be used to monitor white room pressures constantly. These switches give immediate warning of pressure change or failure by operating a light, alarm or remote signaling device. Pressure set point is shown visually with settings down to .05" water (Model No. 1630-.25).

Inter-Area Balancing

The most efficient way to make balancing adjustments to different white room areas is by air flow measurement. For this purpose, the Dwyer Air Velocity Meter No. 400-5 is an extremely practical instrument — showing velocities directly in inches of water **and** FPM. It can be used with a high degree of accuracy to indicate flow of both make-up and recirculated air. Ranges are from 0"-5" of water and 400 to 9,000 FPM.

Continuous Filter Efficiency Check

Optimum dust-free atmosphere depends on maintaining maximum filter efficiency. With Dwyer Filter Gages installed across filter banks, a continuous pressure drop reading is available, indicating exactly when to replace filters.

Write for further information on Dwyer gages and pressure switches.

F. W. DWYER MFG. CO.

P.O. Box 373-A • Michigan City, Ind.

[Circle #22 on page 61]

NEWS of the Industry . . .

(Continued from page 14)

Hospital Air Conditioning Market Is On The Rise

Carrier Air Conditioning Co. reports sales of large equipment for hospital use has doubled during the first half of this year compared to the same period last year.

Russell Gray, president of the company, said hospitals now account for nearly 15 percent of large equipment sales, trailing only the office building and industrial markets for equipment of this type. This represents an increase from about seven percent at this time last year, he said.

Two reasons cited for the recent growth in sales, a boom in hospital construction to cope with an expanding population, and a greater awareness by hospital administrators and directors of the benefits of year-round air conditioning regardless of geography. He said Canada is experiencing a similar surge.

Electronic Air Filters Save Merchandise

Knowing that merchandise soilage from airborne dust and dirt in retail stores can result in serious mark-downs of merchandise the new Joseph Horne Co. store in Pittsburgh installed a system of electronic air cleaners.

Seven Westinghouse Precipitron electronic air cleaners with a total 175,800 cfm capacity. In addition, the system uses one multizone air handling unit rated at 16,600 cfm and six other air handling units with a total capacity of 160,000 cfm.

The air handling units are arranged in four separate in-line systems on the upper level of the store. Each air handling system consists of a matching in-line Precipitron air cleaner, heating and cooling coils and fan.

440 Heat Pumps In 23-Story Building

Because they wanted total environmental control, including lighting, heating, cooling, and ventilation in 400 showrooms and 3½ miles of corridors, 440 heat pump air conditioners were installed around the permimeter of each floor of the new 23-story Atlanta Merchandise Mart.

John C. Portman, Jr., architect of the 15 million dollar all-electric building, said the aim was to provide the most efficient working conditions of any commercial building in the nation.

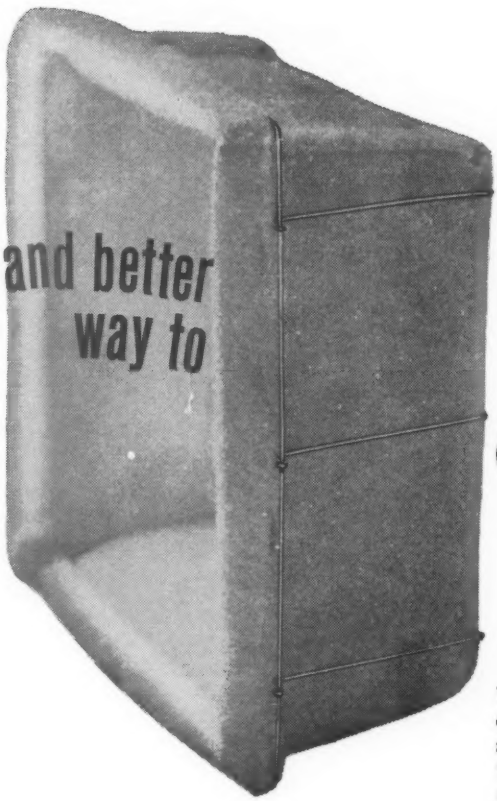
Fedders Corp. Adaptomatic Heat Pump air conditioners were used.

To receive information on any of the New Products, circle the item reference number on the postage-free reply cards on page 61, Communications Center.

12TH NATIONAL EXPOSITION
AIR-CONDITIONING, HEATING & REFRIGERATION INDUSTRY
LOS ANGELES
FEBRUARY 12-15, 1962

For exhibit space, contact: **Geo. E. Mills, Show Director,** 1346 Connecticut Ave., N.W. Washington, D.C. • Phone COlumbia 5-0405

[Circle #25 on page 61]



a new and better way to

CLEAN AIR

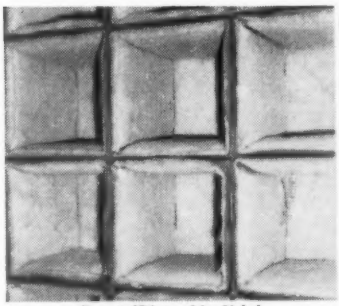
ULOK® Air Filters

Union Carbide research has produced the truly ideal strong, high-capacity filter medium with an irregular, highly-arresting cross section—DYNEL® modacrylic fiber! No other filter medium can touch it for stopping *and holding* unusually large quantities of dust and foreign matter. This dry, un-oiled filter can be vacuum cleaned several times to extend service life even further, if desired.

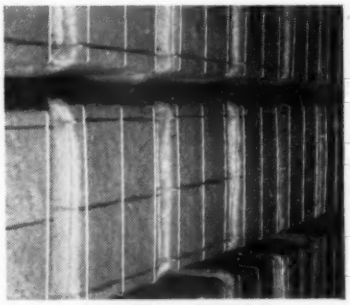
Proved in scores of major installations—in both new and modified systems—ULOK Air Filters are available in a variety of forms to suit any application.

The Remarkable ULOK Cube-Type Air Filter

Shaped like an open-top box with slightly tapered sides, the ULOK Cube-Type Air Filter with *five filtering surfaces* represents the most efficient filter shape yet perfected. In operation, air flow first carries the dirt particles to the back face of the filter. As dirt collects on the back face, and air resistance increases, air flow is shunted to the four sides, assuring uninterrupted filtration. In addition, the ULOK Cube-Type Air Filter provides far greater filtering surface than conventional filters with equivalent face dimensions . . . and the unique design of the wire basket-type retainers and batt edge assures a tight, leak-proof, press fit.

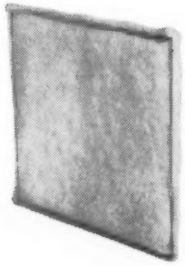


Front (Dirty Air Side) View of Typical Bank



Rear (Clean Air Side) View of Typical Bank

Advantages: • **Up to 600% longer service life over other throw-away filters due to higher dust-holding capacity** • **22% to 28% National Bureau of Standards atmospheric discoloration efficiency** • **Easier installation—filter is light in weight; no sharp edges or "splinters" to hurt hands** • **Lower labor and maintenance costs; lower inventories because fewer changes are required** • **Easier disposal—simply collapse and discard—leaving dirt *in the bag*** • **14 different sizes suitable for all new, and many existing installations** • **Only $7 to $13 per 1000 CFM of air covers total costs (except labor).**



ULOK Panel-Type Air Filters

Patented method of media formation provides a low-density, three-dimensional batt of high capacity DYNEL modacrylic fiber. Entire face and depth of filter traps dirt particles as inherent strength of medium permits elimination of face supports. Modern ring support provides sure-seal edge and eliminates problem of filter by-pass. Particularly suitable for slide-in applications, and all flat or V-bank installations not adaptable to the Cube-Type Filter. Available in 1″ and 2″ thicknesses, in 9 different sizes, from 10″ x 20″ to 24″ x 24″.

For special applications: ULOK filter media is also available in 2″ Pads, 58″ x 60″. . . in ½″ Rolls, 58″ x 25 yards . . . and in 1″ Rolls, 58″ x 15 yards.

For complete information on ULOK Air Filters, including efficiency and pressure-drop charts, write for new bulletins.

UNION CARBIDE

UNION CARBIDE DEVELOPMENT COMPANY
Division of Union Carbide Corporation
270 Park Avenue, New York 17, N. Y.

ULOK, DYNEL, and UNION CARBIDE are registered trade marks of Union Carbide Corporation

[For more information circle #23 on page 61 reply cards]

NOW--rid your White Room of the Unseen Enemy

Summers Gyroscope Co., Inc., Santa Monica, Cal.

If you're still using mops and brooms to clean your white room, chances are there's an unseen enemy lurking overhead or underfoot, ever ready to destroy high quality standards. The extreme care required for the assembly and testing of delicate instruments, precision devices and other equipment calls for special housekeeping techniques.

Hoffman vacuum systems get rid of the unseen enemy—solve tough production cleaning and general maintenance problems—provide maximum efficiency.

To insure truly superclean white rooms, call on Hoffman, pioneers in the development of engineered equipment for dust-free facilities. Hundreds of Hoffman white room systems in plants of all types say we know how.

Write for vacuum equipment catalog and a survey of your white room needs. No cost or obligation.

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HOFFMAN
INDUSTRIES, INC.
A SUBSIDIARY OF HOFFMAN INTERNATIONAL

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[For more information circle #24 on page 61 reply cards]

NEWS

(Continued from page 16)

CAN COOLING BE T-O-O QUIET?

It's possible that air conditioning equipment can be too quiet . . . if it's expected to take the place of permanent sound barriers. AIR ENGINEERING has a report on one such building, to be nameless for the time being, in which the air conditioning units are so quiet that conversations can be heard from adjacent rooms.

Seems that in this building, where conversations must be private for highly personal reasons (it being a doctor's clinic), noise from the equipment is not great enough to mask out conversation in rooms next door. Normal sound attenuation characteristics of conventional construction was not provided.

Meanwhile, engineers who are designing air conditioning systems for buildings having movable inside partitions, particularly where these partitions do not come up to the ceiling, should use the above illustration as a warning to provide enough noise, from some source, to mask out human speech from adjacent partitioned areas.

B&G Plans To Buy Into Reznor

Bell & Gossett Co. recently announced the proposed acquisition of Reznor Mfg. Co., Mercer, Pa., on an exchange of stock basis.

According to R. E. Moore, Bell & Gossett president, Reznor shareholders would receive 18¼ shares of B&G common for each share of Reznor. He said 479,975 shares of B&G stock would be exchanged in the transaction.

The acquisition is subject to approval by Reznor's 90 shareholders, who will vote at a special meeting on Nov. 2.

The newly-acquired company would be operated as a wholly-owned subsidiary of Bell & Gossett, with no proposed changes in management. David R. Webster would continue as president of Reznor.

Letters

Engineer's Ethics

Editor:

It is unethical for a Consulting Engineer to "Bid on a Job."

Would you ask your doctor to bid on removing your son's appendix?

The advantage to the client lies in a flexible fee based on costs such as an hourly rate. This is true since it is not possible to estimate accurately the costs of creative work, leaving the consultant operating on a fixed form of fee frequently with the choice of either losing money or slighting the job. Since incomplete engineering can double the contract cost of the job, the savings in fees are less than negligible. Again, how do you pay your doctor?

Roy Larry Schlein
Consulting Engineer
Philadelphia

Editor:

This (consulting engineer's fee, see p. 4, April, 1961 issue) varies according to the many factors affecting the total design. Some times it is quite impractical and/or not feasible to submit a firm-bid price; other times, when all variables are known and agreed upon, a firm-bid price is possible.

Usually, I have found that where the project details are not clear, it is wise to proceed where and if possible, on a fee basis. This may be preceded by an estimated price, based upon certain known and/or assumed conditions of the job, subject to change according to extra or different requirements of it. In this way the client has a general picture of the approximate cost, while the consulting engineer proceeds on a fee basis.

I personally am inclined to favor a fee basis, primarily on jobs where the total design costs might be affected by unforeseen circumstances.

P. E. Coulter
Professional Engineer
Toronto, Canada

AIR SAMPLING INSTRUMENT MANUAL

A valuable reference published by the *Air Sampling Instrument Committee of the American Conference of Governmental Industrial Hygienists.* It is an up-to-date compendium of instruments containing comprehensive descriptive information on the uses, operating principles, physical descriptions, performance data, operating instructions, maintenance instructions, and commercial source, if any, for almost all of the air sampling instruments currently in use in the United States. In addition, it contains authoritative discussions on air sampling techniques and theory by distinguished authors including Professors Leslie Silverman of the Harvard School of Public Health, and Theodore Hatch of the University of Pittsburgh School of Public Health. **Purchase orders should be forwarded to: Business News Publishing Co., 450 W. Fort St., Detroit 26, Mich.** *$7.50 per copy.*

Editor:

F. H. V., Ohio, asks a question (AIR ENGINEERING, April, 1961, p. 4) on engineering service charges that has a number of implications. Selection of an engineer should be based on professional qualifications exclusive of price competition. Following selection of an engineer on the basis of qualifications, availability to meet time schedules and other related professional requirements, it is entirely proper to discuss a fee arrangement.

The implication in the question is whether it is proper to negotiate a fixed price contract instead of a percentage of construction or some other variable fee basis. The one word "bid" carries connotations of price competition, in which no qualified, ethical engineer will participate.

Methods of payment and the amount, based on the scope of services to be performed by the engineer, are items for negotiation and substantially any method that is mutually acceptable to the client and the engineer would be considered proper. There are a number of methods used to establish a basis for the fee; lump sum or fixed price, percentage of cost of construction, hourly or per diem charges, costs plus a fixed fee, hourly charges with a not-to-exceed maximum sum, and minor variations of these schemes. No one method is appropriate under all circumstances.

The most important decisions in the selection of a Consulting Engineer are his qualifications and full understanding of the scope of service he will provide. A complete and competently prepared set of plans and specifications will minimize construction costs, change orders, and extras more than any saving in fees from a less complete or competent design.

Ralph M. Westcott
Past President
Consulting Engineers Council

Editor:

First, I want to compliment Mr. Norris for his very informative article about the "Electric vs Gas Drive for Big Building Cooling," (p. 22, June, 1961).

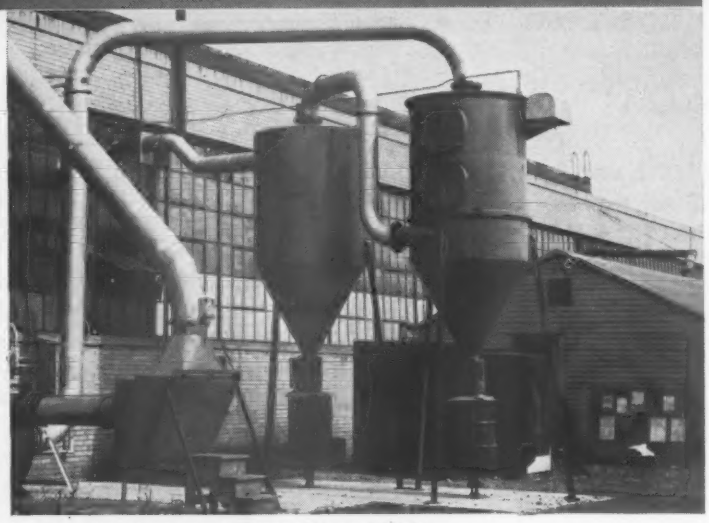
From my experience I found out that when the same utility company supplies all the type of serv-

(Please turn to following page)

CONTROLLING BERYLLIUM DUST

. . . Another Tough Task Made Easier and Safer by

SPENCER VACUUM



The Bendix Corporation, Eclipse-Pioneer Division

Toxic nature of its dust makes beryllium a "problem" metal to machine. But not here!
Spencer vacuum, piped into a specially designed "clean room", picks up the dust right at the machines . . . whisks it away to filter-equipped separators outside the building.
Result: machining is quicker, safer, easier.

Request Catalog No. 155B, "Spencer Vacuum", or write for recommendations on your particular problem.

Also manufacturers of portable vacuum cleaners and pneumatic conveying systems.

The SPENCER TURBINE COMPANY
HARTFORD 6, CONNECTICUT

[For more information circle #27 on page 61 reply cards]

(Continued from preceding page)

ices; i.e., steam, gas, electricity, then the final saving figure on operating expenses has a relative value. If you are in doubt about that, take a look at New York City where similar office buildings in the same area use different type of service for the refrigeration as the most economical.

It is in the best interest of the utility company to spread out its services evenly. And for that purpose the rates are adjusted. On the other hand the over-all cost of the refrigeration equipment is almost the same for any system. This is verified once again in the article of Mr. Norris.

Anthony Zamanis
Mechanical Engineer
New York, N. Y.

Gas vs Electricity

Editor:

The article on page 22 of your June, 1961 issue shows an annual saving by using gas. This would vary depending upon gas and electric rates. Kindly inform me as to the gas and electric rates in Towson, Md., under which this computation was made. I don't think your article tells a thing without the gas and electric rates being quoted.

C. B. Osborne
Sales Manager

Reply To Mr. Osborne:

The tabulation of costs shown on page 23 of the June issue includes the gas and electric consumption for the two systems analyzed. Dividing energy into dollars, we get the following incremental rates for gas and electric power:

Gas incremental rate—$0.727 per Mcf.

Electric incremental rate—$0.0168 per kwh.

These rates apply to the compressor energy only and include demand charges where applicable. The incremental rate for auxiliaries is about $0.0125 per kwh for both systems.

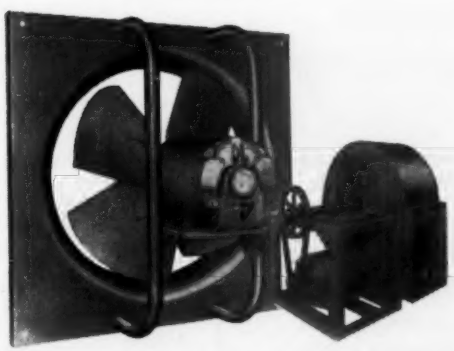
John E. Norris, Jr.
Industrial Fuel Department
Baltimore Gas & Electric Co.

Talk About Fans!

Okay, let's talk about fans . . . Peerless Electric Fans in particular. Breeze or hurricane . . . you name it, and there's a Peerless Electric Fan to produce it. All-welded construction keeps scroll, housing and inlet firm and quiet. Air passes through at peak efficiency. All-welded wheels are statically and dynamically balanced for perfect rotation. Peerless Electric Fans can be specified with confidence, installed with ease, and operate inconspicuously and dependably for years.

Investigate Peerless Air Moving Equipment Today! Write to Peerless Electric Division, H. K. Porter Company, Inc., 1404 West Market St., Warren, Ohio.

Manufactured and sold in the western states by Master Fan Corporation, H. K. Porter Company, Inc., 1323 Channing Street, Los Angeles 21, California. NOW AVAILABLE—Centrifugal Blowers to 132" wheel diameter, Turbo Blowers to 55" S. P., Tube and Vaneaxial Blowers and Industrial Fans to 104" wheel diameter.



PORTER **PEERLESS ELECTRIC DIVISION**
H. K. PORTER COMPANY, INC.

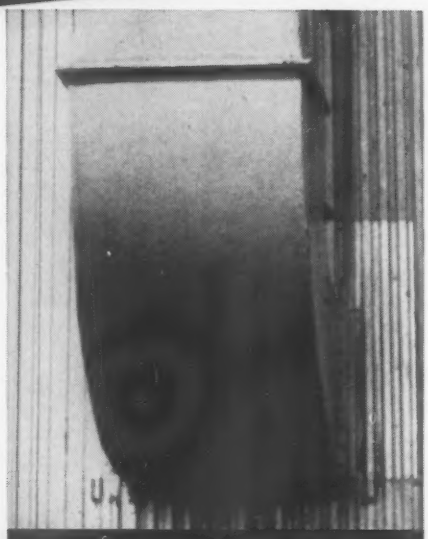
Member—Air Moving and Conditioning Association, Inc.

[For more information circle #28 on page 61 reply cards]

Take your choice

CORROSION RESISTANT* METAL

*After six months in service



CORROSION PROOF* DURACOR

*After two years in service

LIGHT, STRONG DURACOR REPELS CORROSION BETTER THAN METAL . . . LASTS LONGER . . . COSTS LESS

Duracor reinforced plastic withstands attack from almost every known solvent, alkali, reducing agent or oxidizing acid. It can be sawed, drilled, filed or sanded . . . readily fabricated into pipe, duct, tanks, hoods, and other special equipment. High resistance to heat, flame, chemicals and abrasion makes Duracor ideal for severe corrosive service in the metalworking, textile, paper, food and chemical processing industries. Duracor has a high strength/weight ratio . . . needs no exterior protection. Installation is quick, easy and economical. Duracor is fabricated exclusively by The Ceilcote Company, producers of corrosion-proofing materials for industry for more than 30 years.

CEILCOTE OFFERS DESIGN ASSISTANCE . . . BUILDS AND INSTALLS DURACOR VENTILATING SYSTEMS AND PROCESS EQUIPMENT TO CUSTOMER SPECIFICATIONS

DURACOR PROCESS EQUIPMENT

Tensile Strength p.s.i. (D638-S2T)*	11,000-15,000
Flexural Strength p.s.i. (D790-49T)*	20,000-30,000
Tensile Modulus of Elasticity p.s.i.	1.2-1.4x10⁶
Flexural Modulus of Elasticity p.s.i.	0.78-1.6-10⁶
Coefficient of Linear Expansion	9.5x10⁻⁶ in./in./°F.
†Maximum Temperature (Exposure)	500°F.

DURACOR VENTILATING EQUIPMENT

Tensile Strength p.s.i. (D638-S2T)*	8,000-12,000
Flexural Strength p.s.i. (D790-49T)*	14,000-22,000
Flexural Modulus of Elasticity p.s.i.	0.70-1.4x10⁶
Coefficient of Linear Expansion	10.5x10⁻⁶ in./in./°F.

DURACOR CEILCOTE

THE CEILCOTE COMPANY INCORPORATED

4988 Ridge Road
Cleveland 9, Ohio

Please send me your catalog of DURACOR
☐ VENTILATING SYSTEMS
☐ PROCESS EQUIPMENT
NAME_____TITLE_____
COMPANY_____
ADDRESS_____
CITY_____ZONE_____STATE_____

10100-CG

[For more information circle #29 on page 61 reply cards]

Questions

Question:

". . . why a chilled water-washer system could cause asthmatic symptoms . . ?"

Answer:

It is assumed the "chilled water-washer system" is of the type in which air is passed over banks of spray water and the spray water temperature is lower than the wet bulb temperature of the air, and not of the evaporative cooler type which is limited in cooling by the wet bulb air temperature.

Asthma with its difficult expirations is generally caused by certain allergens, the common type being organic dust such as house dust, feathers, and fur. It is probable that any organic material may be allergenic. Other materials besides organic dusts may cause asthma such as inorganic dusts and physical agents. The commonest type of physical agents are heat, light and cold. In respiratory asthma persons may become sensitized to a certain material. The sensitizing is generally the result of a previous exposure; symptoms do not develop, as a rule until some time has elapsed following the sensitizing exposure (days or weeks). If the person is then exposed again to the same sensitizing substance allergic manifestations such as asthma may appear.

Asthma Symptoms

The asthmatic symptoms caused by the chilled water washer type of air conditioner, therefore could be caused by several different types of allergens. Organic material such as algae, molds, spores, insects or even bacteria in the spray water might cause the symptoms. Chemicals discharged into the water supply from industrial plants, water treatment chemicals, insecticides, lignin from wood, and also soluble chemical material leached from minerals in stream or lake water sources, might be the offending materials. Finally the asthmatic condition may be caused by physical agents such as cold, high humidity or water spray droplet exposures.

and Answers

In considering a possible remedy the source of the water supply might be considered. Natural untreated water taken from an unpolluted source would be less likely to contain industrial chemicals. Biological materials would likely be present in stagnant water and water that is recirculated for some period of time. If biological material seems to be the cause changing the water frequently or treatment such as a slight chlorination may reduce organic life. The system should also be examined to determine if there is much carry over of spray droplets and droplet nuclei from the chill water washer. If the carry over is appreciable, water eliminator plates or medium efficiency air filters can be used to reduce the contamination of the air with spray droplets.

Persons with asthmatic symptoms should determine if they are allergic to cold by noting if the same symptoms appear from mechanical air conditioners utilizing refrigerated coils with no water spray.

Sterilamps For Germicidal Work And Negative Ion Use

We would like information on the use of sterilamps both for germicidal work in ducts and as a source of negative ions. We are at present using G-E lamps and Philco Ionitrons to generate ions in our installations and have been doing so for three years.

H.W.

Answer:

Ultra-violet lamps can be used for producing both negative ions and for killing micro-organisms; if the bulb is surrounded by a metal or compound having a low photoelectric work function.

Although ultra-violet radiation from germicidal lamps cannot directly ionize the air, ions can be produced by photoelectrically ejecting metals surrounding the lamp. The ejected electron can attach to oxygen, water vapor, or dirt particles in the air to produce ions.

(Please turn to following page)

PHOTOGRAPH COURTESY OF WESTERN ELECTRIC COMPANY

Angelica Uniforms and Victor Gloves Help Prevent Clean-Room Contamination

Victor Monofilament Nylon Gloves

Angelica has been appointed the only distributor of Victor Gloves, the finest protective gloves made. Victor's non-contaminating gloves of monofilament nylon with plastic coated palms, have maximum touch sensitivity for precision operations. Victor Gloves Inc. collaborated with Bell Laboratories, Inc., in developing these gloves and Bell is currently using them in the assembly of select devices sensitive to physical and chemical contamination.

Other models include ambidextrous gloves and gloves for LOX parts.

Static-Free Dacura* Uniforms

Angelica's coveralls and frocks, of comfortable moisture absorbent Dacura (Dacron** polyester and rayon), are non-linting, acid resistant and static-free. The tight weave of continuous filament yarns resists passage of contamination from the skin or undergarments.

There is a complete "engineer designed" line of Dacura, Dacron, or nylon uniforms and accessories by Angelica and Victor Gloves Inc.

Mail this coupon to the nearest Angelica office below.

*Reg. T.M. H. P. Ogden Co.
**Reg. T.M. of Dupont

Angelica®
UNIFORM COMPANY

1427 Olive St., St. Louis 3, Mo.
107 W. 48th St., New York 36, N. Y.
177 N. Michigan Ave., Chicago 1, Illinois
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Send literature on White Room Uniforms and Gloves.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

[For more information circle #30 on page 61 reply cards]

Questions & ANSWERS

(Continued from preceding page)

The quantity of ions would be determined by the type of photoelectric surface, the quantity of radiation and the amount of air moved past the lamp. Only negative ions would be produced. Thus the same lamp can be used to produce negative ions and destroy micro-organisms.

Aluminum or copper with gold and silver layers have been found best for generating ions. Standard mesh copper window screen flash plated with silver and gold, placed over the lamp tube forms an effective ion generator. This description is given in a paper entitled "Construction of Ion Generators and Measurement of Negative Air Ions" prepared by the Ultraviolet Engineering Staff, Westinghouse Electric Corp.

Use reply card on p. 61 for more information on any product mentioned in an advertisement or new product release.

Ozone Measurement

Your answer pertaining to the use of ozone in the February Question and Answer Column of AIR ENGINEERING was of interest. It listed the effects caused by concentration in ppm of ozone. I am interested in knowing what device was used to measure these concentrations and also what kind of test equipment, mechanical or chemical is available to determine the concentration in ppm of ozone.

R. V. D.

Answer:

Several different methods are employed for determining ozone concentration in the air. They are: chemical analysis, rubber cracking methods and determinations with automatic sampling equipment. A summary of the methods is as follows:

The determination of ozone by chemical methods requires the services of a trained chemist and special equipment, namely a sensitive spectrophotometer.

The air determination is made with a midget impinger or frit bubbler containing a solution of potassium iodide. If ozone is present the iodide is converted to iodate. The solution is acidified and free iodine is liberated which produces a color. The intensity of the color is measured by a spectrophotometer. The color intensity is a measure of the concentration of ozone in the air. Inasmuch as other oxidants may affect the reaction means must be taken to rule out or prevent their interference. Two acceptable chemical methods [1] for ozone determinations are the methods of Smith and Diamond [2] and the method of Byers, Saltzman, and Hyslop [3].

Rubber Cracking Methods

The concentration of ozone in the air can be measured by its effect on rubber. [4] When raw or vulcanized rubber is placed in a bent position under strain, exposure to ozone produces cracks along the edges of the strained area. The cracking action on rubber, specific for ozone, is influenced by the nature of the rubber, concentration of ozone, time of exposure and the velocity of the gas stream to which the rubber is exposed. The method has been standardized in the laboratory by exposing uniform rubber strips to a known concentrations of ozone at a flow rate which is duplicated in field sampling procedure. The number of minutes is noted at which the first signs of rubber cracking becomes evident and the concentration of ozone determined from the laboratory calibrations.

Automatic Recording Instruments [5]

A number of photometric [6] methods are available for recording concentrations of ozone in air.

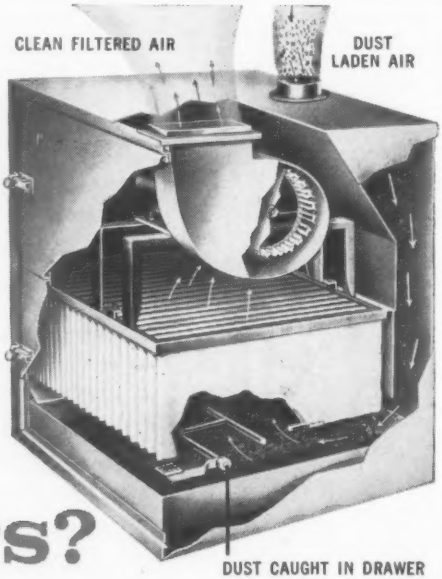
Measurement of the concentration of ozone by the recording potassium iodide colorimeter method is known to be somewhat in error due to the presence of nitrogen dioxide, peroxides or other oxidants. In spite of these limitations the oxidant recorded using this method of analysis is useful in evaluating concentrations of total

(Please turn to page 28)

[Circle #32 on page 61]→

have you got the facts on money-saving preventive maintenance with

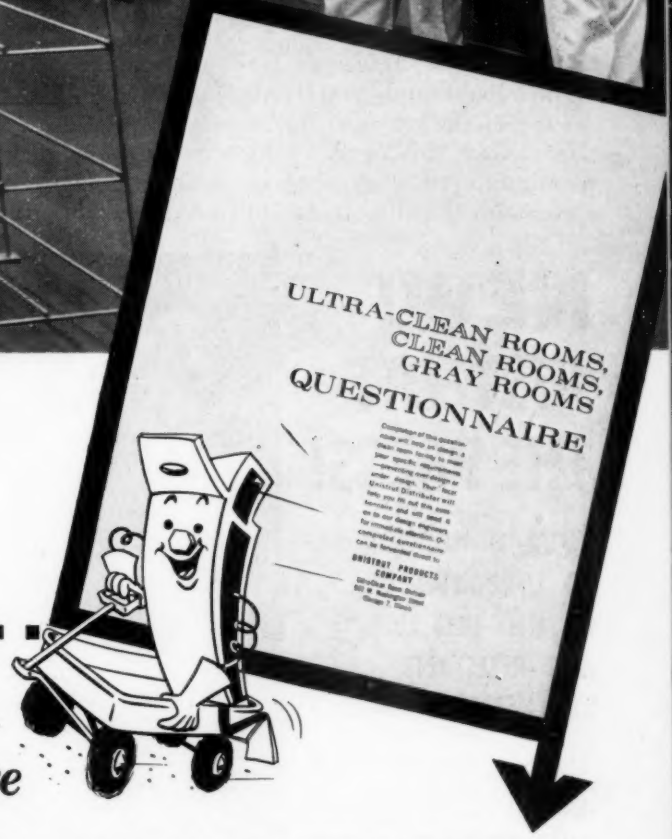
Torit dust collectors?



Clean machines hold close tolerances *better* and *up to 80% longer*. Result: a measurable saving in both the cost and frequency of servicing and maintenance work. You can protect your client's plant and equipment investment, help reduce potential production breakdowns, by specifying TORIT Dust Collectors. In the cabinet type (illustrated by cutaway drawing) filters are rated 99.99% efficient by weight on particles as small as ½ micron! Compact Torit high efficiency cyclone and cabinet type units are designed to save space, install anywhere. Your Torit representative will gladly give you dust collector specifications, performance charts, dimensional drawings and installation suggestions. Write:

TORIT MANUFACTURING CO.
1133 Rankin Street • St. Paul 16, Minn. • Dept. 1917
[For more information circle #31 on page 61 reply cards]

Modern clean room at new plant of Flexonics, Division, Calumet and Hecla, Inc.



To help you plan your CLEAN ROOMS...

here is a brand new data-guide questionnaire

This practical new guide will help you take those important first steps in planning a clean room to meet your specific manufacturing requirements.

Step by step, it guides you in properly analyzing your present plant facilities — properly organizes the many factors required in developing the right specifications—*avoids under-designing and over-designing.*

This new UPC data-guide was developed by experienced UPC engineers, recognized leaders in clean room designing, engineering and construction.

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Questions and *Answers*

(Continued from page 26)

oxidants in the atmosphere. Several instruments employing this principle are available.

A portable atmospheric zone recorder developed by A. W. Brewer is produced by the Mast Development Co. This is called a microcoulomb ozone sensor. This instrument operates on the principle of a continuous coulometric measurement of a flowing solution of potassium iodide which has been in contact with the sampled air stream. The sensitivity achieved so far is only 1 ppm which does not extend down to the range of interest of industrial hygienists.

Electrometric Recorder

An ozone recorder operating on a different electrometric principle as developed by V. H. Reginer is also produced by this same manufacturer. Air is drawn through two systems each containing a flowing solution of potassium iodide and sodium thiosulfate continually titrated to a point of slight excess iodine. In one of the systems, the oxidant content of the air is destroyed by heat; in the other the oxidant oxidizes the iodide, proportionally decreasing the required electrolysis current. The difference in currents between the two systems is a measure of the concentration of oxidant present in the air stream and is recorded on a strip chart.

The Kruger Model 54 Ozone Analyzer [8] is based on ultra violet absorption of this gas. The air sample is divided into two parts, one of which passes directly into a test cell and the other over a catalyst to eliminate ozone and then into a reference cell. The difference in ultra violet absorption at 2537 A between the test cell and the reference cell is measured by a bridge circuit. The instrument is specific for ozone.

Bradley and Haagen-Smit [7] [9] have developed a technique which uses the cracking of small folded strips of rubber as a means of determining ozone concentration. The specially compounded strips of rubber are exposed to a known volume of air; the extent of cracking is a function of the concentration of ozone. A needle is drawn across the rubber strip to indicate the depth of the cracks. The motion of this needle is transmitted to a strip chart to provide a recording.

Beckman Instruments, Inc. has produced an instrument based on a method also developed by Haagen-Smit in which phenolphthalin is oxidized to phenolphthalein and the color change read on a recording colorimeter. ▲▲

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Question

How can you protect bacteriological personnel and public from highly contagious organisms?

L.H., Conn.

Answer

There are several methods of providing protection for bacteriological technicians from virulent organisms by ventilation. Special stainless steel hoods, with openings to insert the hands and arms to perform the work and sloped glass viewing windows have been used.[1] Air flow of 100 linear feet per minute at the hood opening or a total of 800 cfm per hood gave control. Asbestos bearing paper filters of the high efficiency type were used to remove the organisms from the discharge air stream.

Glove box type ventilation can also be used for handling virulent organisms.[2] Because of the good enclosure lower airflows can be used.

Electrostatic precipitators have been found effective for the removal of pathogenic bacteria from the air stream.[3] [4] [5] Reported results show high efficiencies.

Commercial available fibrous filters[6] have a National Bureau of Standards efficiency of 90-95% against bacterial droplet nuclei and 99 to 100% for dustborne bacteria.

Certain glass fiber media were found to have an efficiency of 99% for bacteria and viruses.[7] The combination of electrostatic precipitator and spun glass filter pads has been used[8] and efficiencies of 99 to 100% have been reported for bacteria and viruses.

Methods of sterilizing the contaminated air of organisms utilizing heat have been reported. Gas fired incinerators have been employed in several locations.[9] [15] Electric grids have been reported to have given good results.[10] Steam jets have also been reported for decontamination.

Ultraviolet radiations have been utilized in air

(Please turn to page 59)

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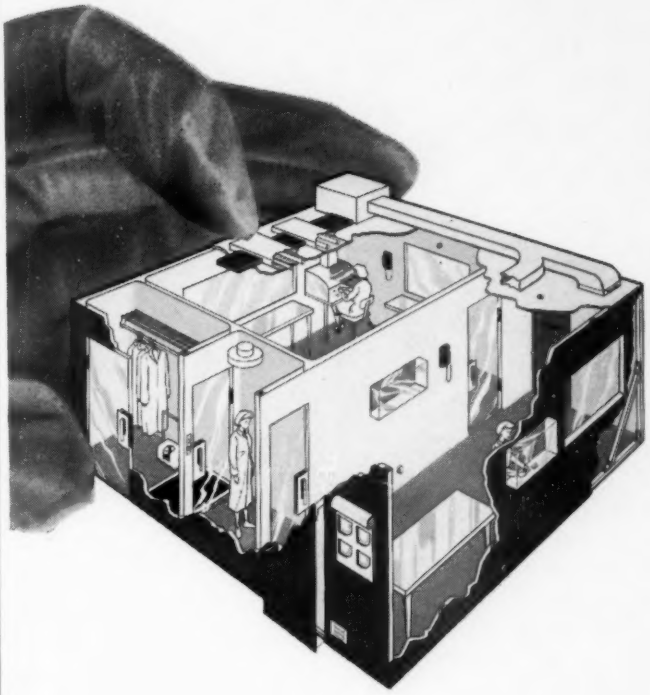

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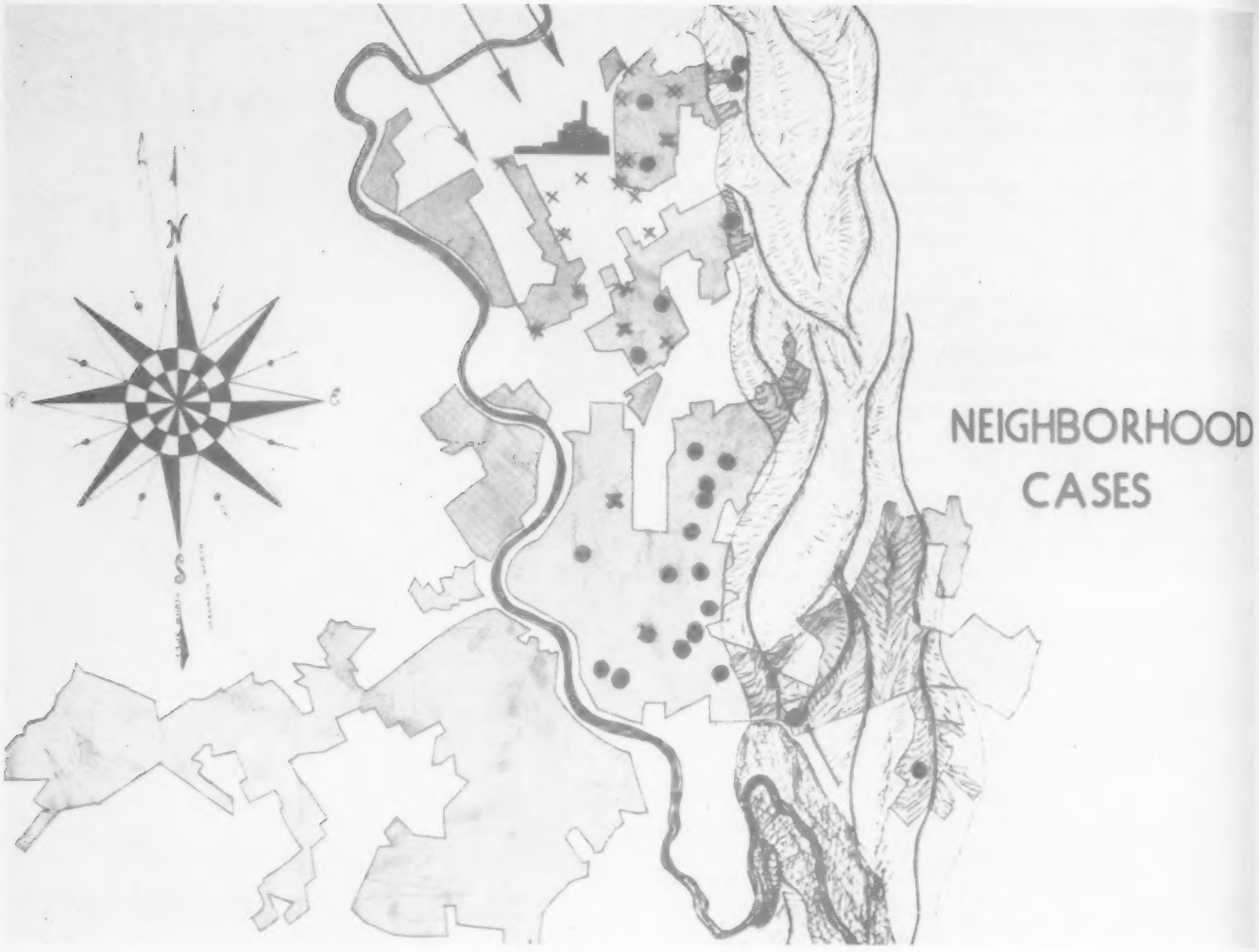


For plant engineers and consulting engineers . . .

Community Cases of Berylliosis

BERYLLIUM DISEASE is to date the only generally accepted chronic disease entirely due to air contamination of the community atmosphere. Thirty-seven cases reported in this paper have been thoroughly investigated and no other significant contact with the causative agent except the breathing of contaminated community atmosphere could be established.

The disease is identical with the chronic berylliosis reported from occupational exposure and manifests itself by loss of weight, weakness, shortness of breath, diminished vital capacity, and circulatory failure. The roentgenographic changes are characteristic and resemble those of sarcoidosis or pneumoconiosis.

For the purpose of this paper community cases are defined as those living in the neighborhood of a plant which may have been the source of atmospheric contamination with beryllium. Community cases are to be distinguished from those exposed either occupationally or through contact with contaminated clothing brought home for washing. The non-community cases usually have had a much higher exposure than community cases (which were exposed to relatively low outdoor levels).

The first community cases were reported from Russia and Italy where the symptoms of the disease were discovered in inhabitants of industrial areas where beryllium was used. These cases were originally attributed to fluorine, a concept which was later found to be erroneous[1].

In the United States, community cases of beryllium disease have been reported in areas adjacent to beryllium refineries and fluorescent bulb plants[2].

If you machine beryllium or are designing a plant for this purpose, you'll find much of value in this article on the health aspects of beryllium processing.

by **Jan Lieben, M.D.**
National Health Council

Early in 1942 cases of berylliosis occurred in a New England city among workers exposed to zinc beryllium silicate, used in the manufacture of fluorescent lamps. Shortly thereafter a woman living close to the plant, who never had worked inside the plant, became ill with symptoms and signs typical of those of occupational exposure. When the woman died the diagnosis of chronic beryllium poisoning was confirmed by autopsy. No other cause for death was found. The location of the plant's exhaust system and the direction of wind currents made exposure to zinc beryllium silicate a possible cause for her disease. The woman's history confirmed this hypothesis. She stated that, not infrequently, a white dust, which evidently came from the neighboring plant, filtered into her house. There were two other cases of beryllium disease which may have been due to air pollution, but their documentation was not as complete as the one just described.

Air Contamination

Atmospheric contamination by a beryllium compound and the appearance of community cases has been described by Eisenbud (p. 40, August 1959 AIR ENGINEERING). The exposure occurred in the forties in the neighborhood of a plant in Northern Ohio where beryllium was produced. Knowledge of beryllium poisoning has been gradually disseminated and the physicians in the community have become aware of the clinical aspect of the disease.

Several other cases in the area of this plant soon came to light. Most were discovered by chance in local hospitals. Over a several-year period eleven cases were discovered including three deaths. All of the diagnoses were confirmed either by autopsy or by review of specialists familiar with the disease. In order to determine the extent of the problem, plant management requested a chest X-ray survey of the community which was carried out by the State Health Department.

X-Ray Analysis

Approximately 10,000 persons were given photoroentgenographs on 70 mm film and 600 were followed up by X-rays on standard 14 x 17 films because of suspected lung disease. Two in this group were found to fulfill the criteria of chronic beryllium poisoning, bringing the total to 11 cases. The location of these cases, with respect to the plant, is shown in Table 1[2].

It was estimated that about 500 people lived within ¼ mile of the plant. The incidence of disease within ¼ mile, therefore, approximates one percent. It should be noted that 10 out of 11 patients lived within ¾ mile from the plant but one lived almost two miles distance. None of these affected persons had any occupational exposure to beryllium. The two-mile case, however, was a woman whose husband had been employed in the beryllium plant for a period of three months some time previous to the onset of the symptoms. She was known to have handled his work clothes daily.

Air sampling in the vicinity of the plant, with continuous samplers using Whatman 41 filter paper, showed a range from 0.000 to 2.1 micrograms of beryllium per cubic meter. The stations were located at distances of 350 to 750 ft. from the plant.

From Table 1, not counting the two-mile case, it appears that all affected persons lived in the ¾ mile radius for some period prior to 1946. The average concentration at the ¾ mile radius ranged between 0.04 and 0.02 micrograms per cubic meter. The authors conclude that the lowest concentration which produced the disease was greater than 0.01 micrograms per cubic meter of air and probably less than 0.10 micrograms per cubic meter. This conclusion formed the original basis for the present outdoor maximum allowable concentration of 0.01 micrograms per cubic meter.

TABLE I

DISTANCE FROM PLANT	NUMBER OF CASES
0 - ¼ mile	5
¼ - ½ mile	3
½ - ¾ mile	2
¾ - 1 ½ mile	0
1 ½ - 2 mile	1

A third group of 26 cases was reported recently from the neighborhood of a beryllium refinery and alloy fabricating plant in Pennsylvania. These cases were obtained from physicians' reports, personal contacts, and from an extensive search of hospital files. The onset of symptoms occurred over

(Please turn to following page)

(Continued from preceding page)

a period of 12 years. The first reported case occurred in 1947 and the last in 1959[4]. Only cases which fulfilled certain diagnostic criteria were included. Others in whom the obtainable information was insufficient were not reported.

The plant under study occupies approximately 15 acres, much of which is devoted to the storage of beryl ore. It is located in a shallow valley. Nearby mountains to the east and south range between 800 and 1140 ft. Towards the northwest and west the country is rolling, with hills seldom exceeding 500 ft. in elevation. The prevailing wind directions are from the northeast for nine months of the year—the other three months from the southeast.

The locations of the neighborhood cases of non-occupational beryllium disease are shown in Fig. 1. It should be noted that the locations of these cases follow to a large extent the distribution of areas of dense population. The fact that most of the neighborhood cases appear to be downwind of the plant may have significance but, as can be seen from Fig. 1, the community is not uniformly distributed around the plant.

One of the cases lived within 0.7 miles of the plant; eight cases lived within two miles of the plant, and the rest of the cases lived within three to six miles and in the area of densest population. The total population of the area is approximately 100,000.

Seventeen of the cases were females and nine were males. Four of the cases were under 20 years of age, five between ages of 20 and 40, nine between 40 and 60, and eight were above the age of 60. Eight out of the group had died at the time of the study and details of these cases were obtained from hospital records and physicians' files.

In six cases autopsy reports and historical studies were available.

Several other cases are presently under medical supervision.

With the aid of a National In-

(Please turn to page 44)

How To Collect Beryllium Dust

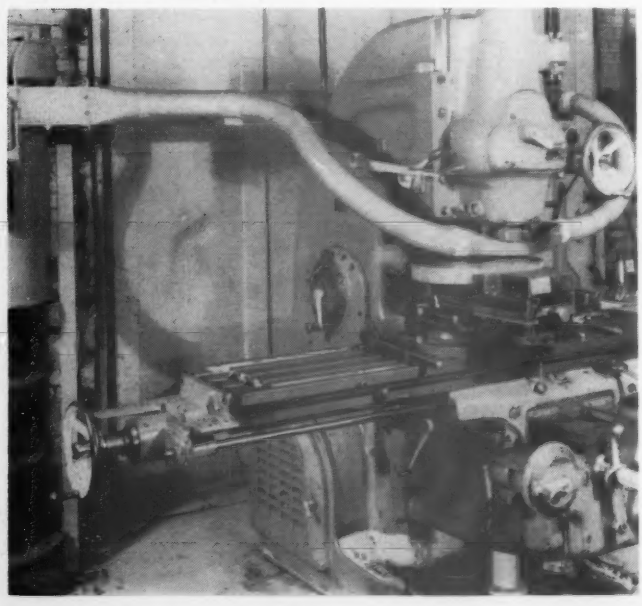
LARGE tonnages of beryllium can be handled without health hazards, provided good ventilation procedures are followed.

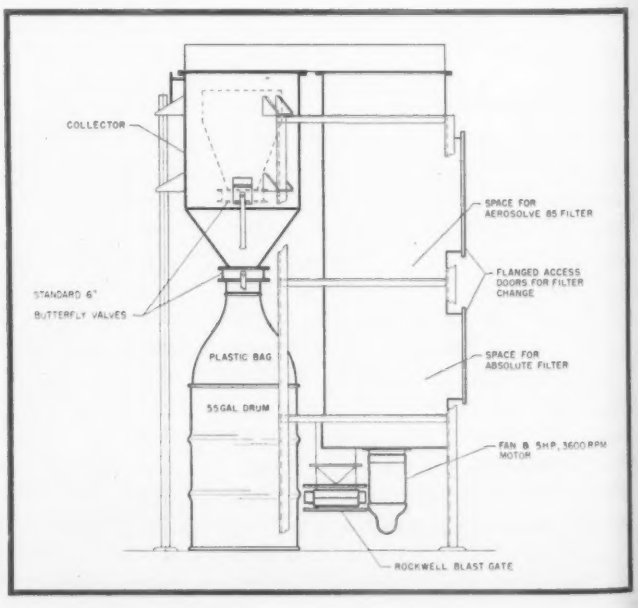
If you machine, drill, grind or mill beryllium, one way to keep resulting beryllium dust away from machine operators is to use a dust collection system like the one shown in Fig. 1, at left, below.

The hood in Fig. 1, on a milling machine, is right at the point where the milling tool cuts into the beryllium metal. The hood is designed to produce a face inlet velocity at the hood of about 6000 fpm air flow. Dust is conveyed to the collector through 2½-in. flexible duct. Note that the collector, at left in Fig. 1, is designed to fit snugly over a 55-gal drum.

Another similar collector is shown in Fig. 2, which is designed to be integral with a plenum chamber, fitted with super-interception filters. ▲▲

Photo and drawing courtesy Aerotec Industries, Inc.





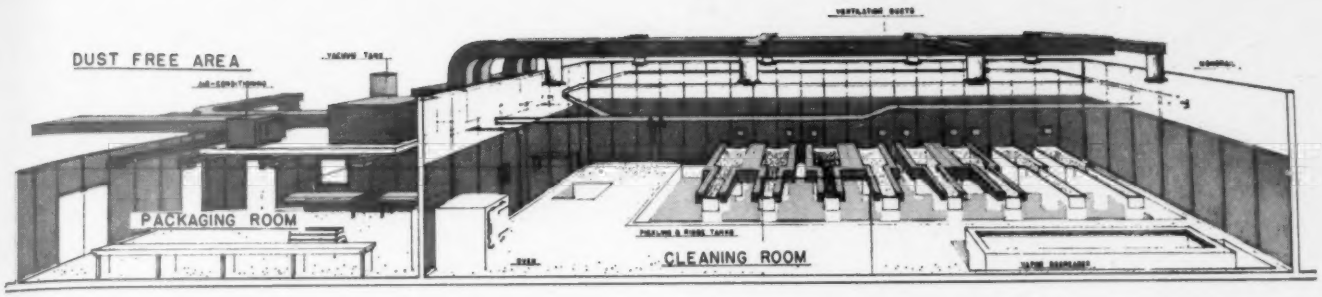


Fig. 1: New "clean room" at Flexonics is designed to keep incoming air free of dust particles down to 10 microns. Dust-free area is shown at left, "gray" room facility is shown at right. Rooms are used in the fabrication, cleaning and packaging of metal hose and for contract white room work with other manufacturers.

You can avoid the high cost of obsolescence of your clean room facility by designing it so that future additions can be made by adding to rather than by replacing basic equipment. In this fast-changing field of contamination control, you can take a tip from this . . .

Clean Room Design At Flexonics

by S. H. Bokemeier
Quality Control Manager
Flexonics Division of
Calumet & Hecla, Inc.

THIS BUSINESS of contamination control is moving so rapidly that facilities such as "clean rooms" built today may be obsolete tomorrow. That's why, when we built our new clean room facility at Flexonics, every effort was made to keep the original high investment intact despite potential "state of the art" obsolescence. We anticipated obsolescence by designing the clean room so future changes could be made without having to build an entirely new facility.

Our new "clean room" will keep incoming air at a ten micron level in evaluation, packaging and laboratory areas; and in the cleaning area at a 75 micron level (Fig. 1). However, the air handling system can be altered to permit a lower dust count of smaller dust particles by adding to the system, rather than by replacing components. Other provisions will permit finer control if bacteriological requirements are added to particle and chemical criteria.

Our clean room facility is used in the fabrication and cleaning of flexible metal hose and large ducting assembly, and is available to other firms on a contract basis for product final assembly, cleaning and packaging.

Our cleaning facility is divided into a 3700 sq. ft. "gray" area and a 3000 sq. ft. "white" or super-clean area. The gray area is used for degreasing, chemical treatment, flushing, drying, etc. The super-clean area is used for final touch-up cleaning, product evaluation or inspection, laboratory and final packaging operations.

We have not provided a personnel entry between the gray and super-clean rooms, because of the possibility of contamination carry-over from the gray rooms to the super-clean area. Each area has its own entrance air-lock, which will be described in detail in this article.

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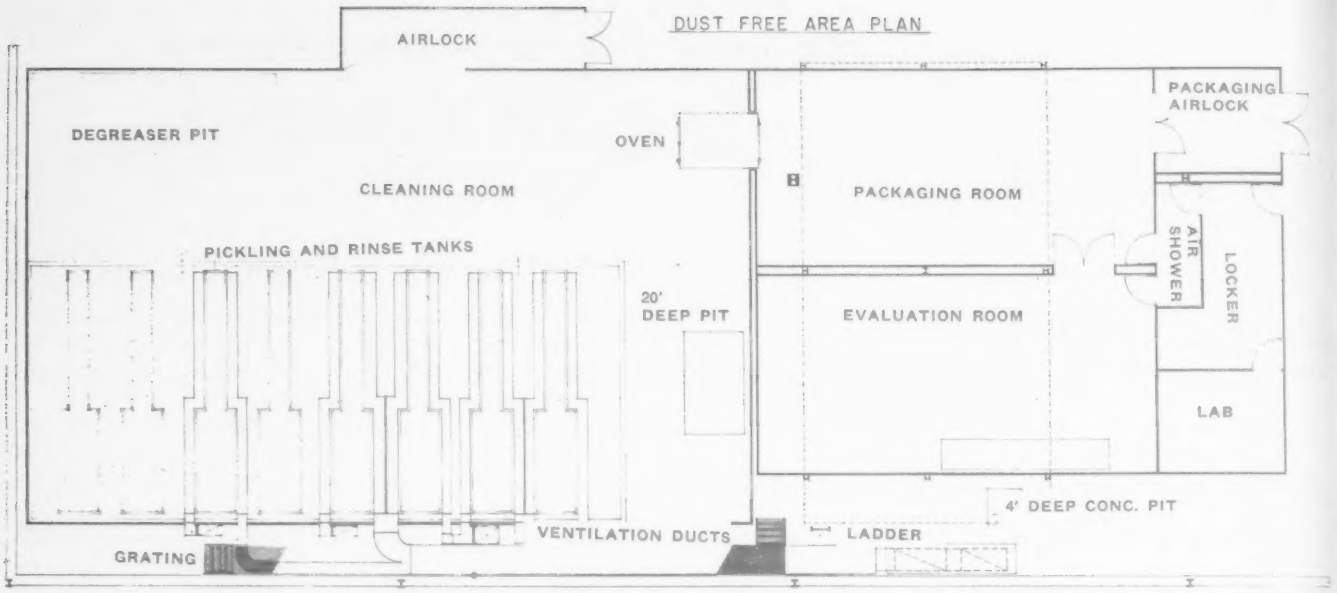


Fig. 2: Plan of contamination control facilities at Flexonics. Each area has its own separate entry through an airlock. Super-clean area at right also has an air shower arrangement and materials handling airlock.

(Continued from preceding page)

Air Conditioning Design

One of our toughest problems in system design was posed by a need for make-up air while keeping the gray room under positive pressure, without losing large amounts of filtered air.

We had to make-up 26,000 cfm lost to a push-pull exhaust system over eight large (4'4" x 24') chemical tanks and a large vapor degreaser.

Our solution was to zone the system and use two completely separate pressurization and filtration systems for the gray room or cleaning room (Fig. 1), and another system for the evaluation, lab, packaging rooms, and air locks (at left, Fig. 1).

Air for the white or super-clean area (shown as packaging area on Fig. 1) is brought into the system from the outside through roof intakes and fed through a continuous roll electro-static pre-filter, through pre-heat coils (or cooling coils during summer), then through super-interception filters. Space thermostats modulate the steam preheat coils to maintain desired discharge air temperature of 68°F. A humidistat operates a humidifier valve to maintain inside design conditions of 32% RH in winter. Summer inside design conditions for the super-clean area are 30-40% RH. Summer conditions are maintained by the space thermostats and humidistat which controls a liquid solenoid valve and resets control point of refrigeration compressor.

Positive pressure is maintained in both areas by static pressure controls, which modulate return air dampers.

As design conditions show, only the super-clean room is air conditioned.

As a visible check on maintenance of positive

DESIGN CONCEPTS IN PLANNING FLEXONICS' "CLEAN ROOM" FACILITY

¶ Dirt-collecting areas reduced to minimum by recessing door and window moldings, switch boxes, service outlets and similar equipment.

¶ Contaminant fall-out from ceiling stopped by sealing and recessing lighting fixtures and through the use of "floating" ceilings.

¶ Shedding, chipping, oxidizing, cracking, peeling of surfaces prevented by using inorganic materials with hard, non-shedding surfaces for all surfaces.

¶ Dust infiltration stopped by maintaining positive air pressure in clean rooms.

¶ Contamination from ductwork oxidation and corrosion avoided by using stainless steel supply duct.

¶ As much equipment as possible was kept out of clean rooms.

¶ Motors for vacuum system, deionizer, etc., located outside.

¶ Service shafts, lines, etc., go through sealed openings in walls to equipment inside. Where equipment like hand tools, hoists must be inside, inorganic lubricants were used and equipment coated with non-shedding, tough epoxy resin paints or plated.

¶ Use of wood avoided throughout.

¶ Synthetic seals and gaskets were used on light fixtures, shaft and power line openings in walls, etc., to prevent particle shedding or chemical breakdown.

pressure in each clean area, manometers were installed within each room. For immediate indication of failure of any air handling system components, an alarm in the facility gives visual warning.

Parts and materials pass from gray to white areas through an inter-locked double doored vacuum oven, which serves both as an air lock and as an efficient dryer of cleaned units.

Personnel entry to white room is through a double lock. First lock (Fig. 2) is used by personnel for dressing in tight-fitting, lint-free coveralls, foot coverings and head covers. Second lock has a high efficiency vacuum nozzle for removing dust from clothing prior to entering critical area.

Wall and Ceiling Construction

To minimize effects of vibration and expansion movement, walls and ceilings of the entire facility were built independently of the general factory building walls. An 800 sq. ft. concrete platform was constructed over the ceiling of the packaging room (Fig. 1) for space for blowers, filters, air conditioning equipment, deionizers, vacuum systems, etc. This platform has footings for the structural steel, isolated from the general factory floor, to eliminate vibration from equipment within the facility itself.

For pressure tight wall and ceiling joints, ease of servicing after equipment installation and minimum cost for future expansion, we built the contamination control facility out of channel framework, with pre-fab panels of laminated construction with porcelain on steel as the exposed surface, and galvanized steel on the panel back. Windows and doors were installed in extruded aluminum frames. Figs. 3 and 4 show this construction. Snap-on batten strips conceal edges of panels. White room is built of 10′ x 4′ porcelain panels, flush mounted to steel channeling, sealed with stainless steel cap covers, which provides a virtually crackless joint.

Hollow panel wall construction permits flush mounting of electrical and vacuum outlets, eliminates conduit, pipes and other service lines from interior of facility.

Window and door frame projections are only about 1/16″ at a 45° angle to reduce particle retention on projections.

Gray room and white room walls and ceilings are of the same construction, except that in the gray room, cement asbestos panels were substituted for the porcelain-on-steel. Gray room panels are sealed with a sprayed coat of cured vinyl plastic, which forms a pressure tight "breathable" membrane resistant to acids and solvents.

Floor Construction

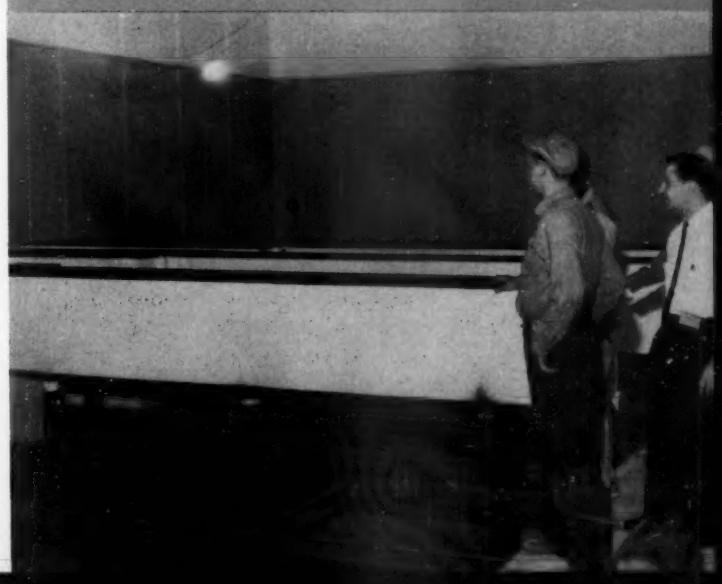
In the gray area, floors were recessed for chemical tanks, vapor degreasers and flushing operations (Fig. 5). Floors were coated with epoxy resin pigmented

(Please turn to page 58)

Fig. 3: Steel structural members and panels for Flexonics clean room facility were pre-engineered. Hollow walls facilitated flush mounting of fixtures.

Fig. 4: Above: Walls are of porcelain-on-steel. Fluorescent fixtures are flush with ceiling.

Fig. 5: Below, degreasing pits were recessed in the floor.



For parallel lines accurate to one-tenth of a millionth of an inch . . .

Precision Climate At Bausch & Lomb's New Grating Lab

. . . is accurate to ± one hundredth of one degree F.

by Michael A. Pena
Plant Engineering Staff Adviser, Air Conditioning and Ventilation
Bausch & Lomb Co.

THE PARALLEL lines ruled by a ruling engine in a piece of coated optical glass, to make a master diffraction grating, must be precise to an accuracy of one-tenth of a millionth of an inch. Otherwise, for use in spectrum analysis of materials, the diffraction grating is not usable.

Because diffraction gratings are finding increasing use in outer space rocket probes, for upper atmosphere analysis, and in diffraction grating spectrometers, Bausch & Lomb had to increase its facilities for producing these gratings.

Due to the extreme accuracy required in ruling these gratings, temperature had to be controlled to a bilateral tolerance of one hundredth of one degree in the grating and scaling ruling engine rooms or cells.

Master scales, as opposed to master diffraction gratings, are scales used in their original form or as master references in the manufacture of a multitude of scaled devices such as architect's calibrated rulers, vernier scales, and other scaling instruments. Although scales are ruled with parallel lines farther apart than diffraction gratings, similarity of operation permitted grouping of both operations within an isolated area consisting of four zones under conditions which conform to requirements as set up by standards agencies, such as the U.S. Bureau of Standards.

The cells, or rooms, containing the ruling engines are for purposes of maintaining accurate temperature control physically isolated from the other areas of the new building and from outside walls. Thus the ruling engine cells are isolated from outside transmission and solar loads by an envelope of other rooms which surround the four engine cells or rooms, as shown in Fig. 1.

The envelope area, Fig. 1, consists of an electronics area on either side of the four ruling engine rooms, and which contain controls for the ruling engines. The other two sides of the four cell critical area "A" consist of a passageway and a scaling laboratory for research and test. Entrance to critical areas, including the inspection area, is through an airlock. Personnel must step on a sticky mat in the airlock to remove dirt from shoes, and in the cementing area also wear lint-free garments, for reasons to be described later.

Master diffraction gratings are stored in a controlled temperature storeroom, next to the inspection area, as shown in Fig. 1.

The new grating facility is built on the site of an old residence which was located adjacent to the old grating facility.

Proximity of the old residence and underground lab to the new lab was such that a foundation wall of the demolished residence was left intact for use as a partition within the new Lab building. The relative location of bed rock to first floor level (100.0 ft.) of an adjacent building to be used for gaining access to the lab from

the rest of the plant, and sidewalk (104.0 ft.) from which outside entrance would be gained, established the design feature of incorporating two levels within the single story building. The lower level (95.0 ft.), being approximately at bed rock level, to be utilized as a foundation over which to locate the cells (rooms) that house scale and grating ruling engines, and adjacent processing area.

These areas, along with the grating test area on the upper level, constitute the critical areas (critical with regards to being a part of the grating and scale operation requiring exacting temperature control and fine filtration). The upper level or entrance level constitutes the non-critical general areas to be discussed later. This two level feature as mentioned above proved to be highly advantageous in isolating the cells from the effects of changing outside transmission and solar load effects by allowing ample space above the rooms for efficient distribution of conditioned air to cells and adjacent envelope area. The single story lab is a windowless building designed for possible future addition of another floor, and is provided with capped column extensions above roof level. Because of the lack of available space within the building, and in order to keep roof relatively clear for future expansion, the mechanical equipment room housing all refrigeration equipment, chilled condenser and tower water circulating pumps and motor control panels for the non-critical areas, was built in the building adjoining the new lab (Fig. 1).

The building is basically divided into three areas, known as A, B and C areas. Area "A" is regarded as the critical area and has six zones, four of which are the four ruling engine rooms, one the envelope area and one the grating test area (Fig. 1).

Areas B and C are non-critical and have eight zones, one of which consists entirely of area C.

Outside design conditions for summer are 95° DB and 78° WB. Winter outside design is -5° F.

The following data established from a preliminary survey and solution to the problem gives the design conditions of temperature, humidity and air movement within each of these zones.

Area A—For Each Of The Four Ruling Engine Room Zones

45% Max. rh
68° FDB ± .01°

Conditioned air to be delivered with utmost stability with regard to temperature and distribution in order to maintain a constant temperature gradient at the engine level.

NOTE: There will be no occupancy within the operating grating engine cell for a period of

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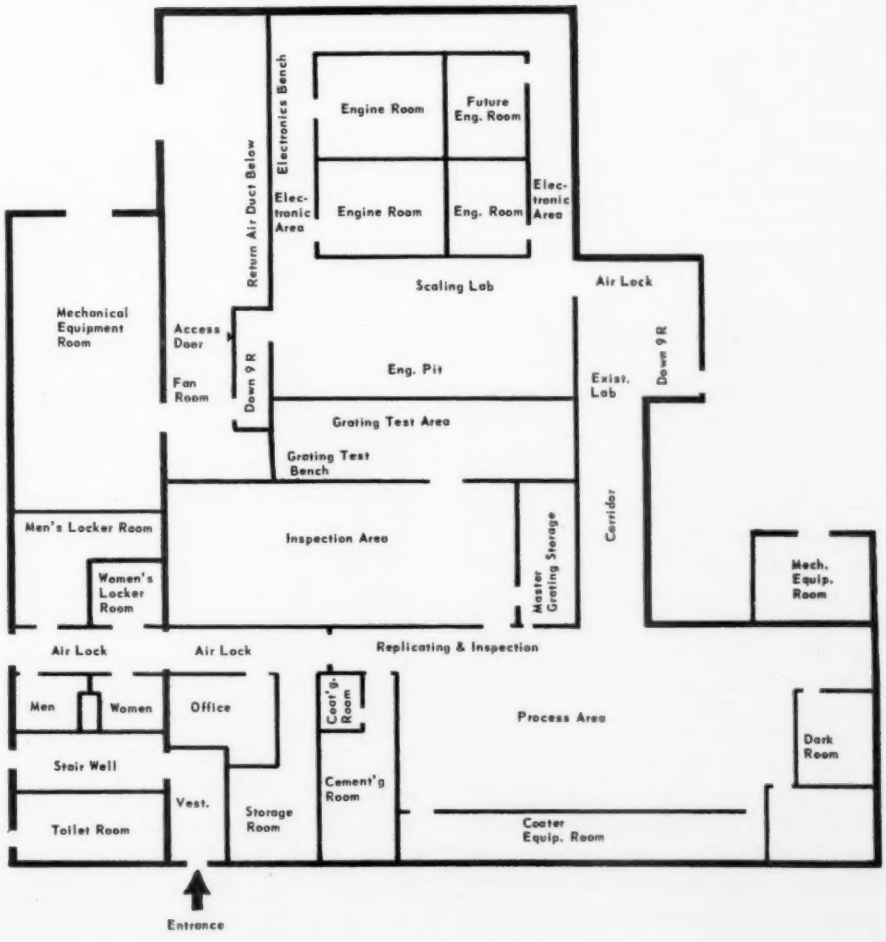
Fig. 1: Below, layout and floor plan of Bausch & Lomb's diffraction grating laboratory. Four engine ruling rooms and surrounding corridor are considered critical areas in which temperature is controlled to .01°.



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18 hours after final set-up, and continuing throughout the entire automatic grooving period.

Area A—For Envelope Area

68° FDB ± .25°
45% Max. rh

A highly refined and flexible conditioned air distribution system is essential in order to maintain the close temperature tolerance specified while maintaining draft free distribution of extremely low temperature air to an occupied area where personnel will be doing sedentary work for relatively long periods.

Area A—For Grating Test:

68 — 74° FDB ± .25°
45% Max. rh

Conditioned air must be distributed at low velocity through a highly flexible air supply system that can be balanced to provide exacting temperature control throughout the entire area while preventing turbulance at any point along the entire length of the 37 ft. long precision testing monorail.

Area B-C—Non-Critical Areas

74° ± 1½°
45% Max. rh

This area occupies approximately ⅓ of the Lab Building and is located on the upper level of the building. It is separated from the lab by an air lock and is accessible through its front entrance at street level as well as adjoining plant building.

There are no critical requirements for air distribution in this area.

The new building has 97 ft. of frontage x 114 ft. front to rear. Its 10,000 sq. ft. of area is supplemented by the 620 sq. ft. mechanical equipment room located adjacent to the lab in the adjoining building (Fig. 1).

Each of the Scale Ruling and Grating engines must be anchored to a stabilizing mass of concrete which is isolated and held in suspension by a spring loaded system resting on an insulated foundation of concrete and bed rock (Fig. 2).

The Actual Solution

The consulting engineering firm of Eggly & Furlow Engineers, (now John W. Furlow Engineers) and Carl Traver Architect were retained through John B. Pike & Son, Inc., General Contractor, to come up with a master scheme that would satisfy all aforementioned requirements. The following describes actual solution as solved by Furlow and Traver.

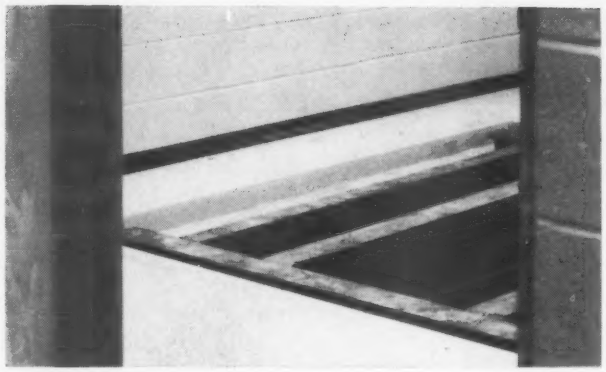


Fig. 2: Left, the ruling engines are mounted on heavy steel beams anchored to concrete.

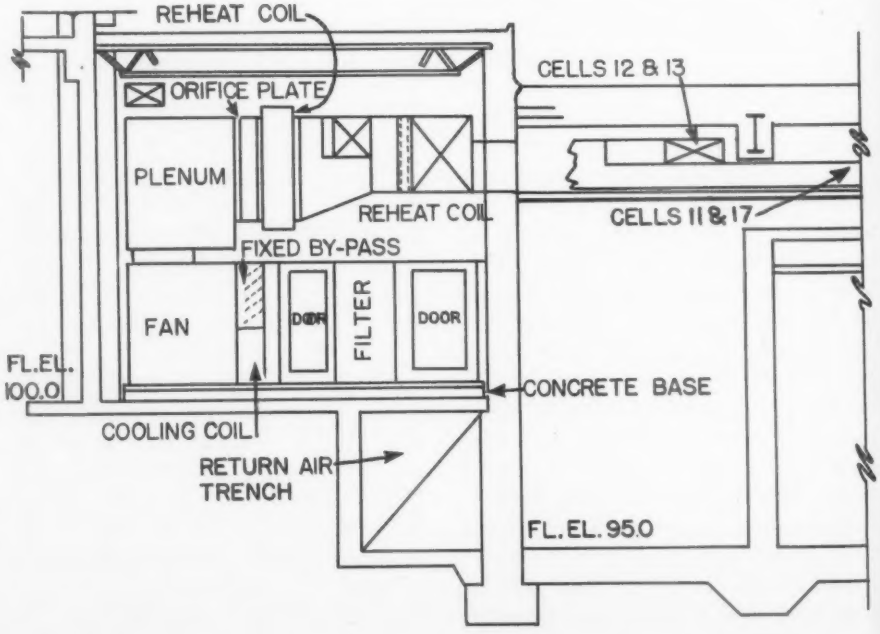
In addition to an existing air conditioning system serving the existing Grating Lab there are three typical fan-coil air handling units, each having chilled water cooling coils, hot water primary reheat coils, centrifugal fans fixed or thermostatically controlled by-pass dampers, and filter housings. One of the three above units is used for cooling Area A Fan Room and merely recirculates air to keep temperature of this room which is adjacent envelope Area at an acceptable constant.

The second unit (A-1) is also located in Area A fan room and serves area A cells, envelope zone and grating test room as shown in Fig. 3. The third unit (B) serves the eight zones of the non critical B and C Areas, Fig. 4.

A minimum amount of outside air to air condition Unit A-1 is introduced at constant volume into a concrete return air tunnel located just below grade and surrounding the NE and S walls of the envelope zone.

The floor of this tunnel is level with envelope zone floor. The tunnel serves the manyfold purpose of eliminating the necessity of return air ductwork from envelope, cell, and grating test zones, thoroughly mixing outside air with negligible stratification or change in return air temperature, stabilizing heat transmission between tunnel and envelope zone, and permitting strategic location of return air grilles so that concentrated heat from electronic equipment in envelope area goes directly to the return air rather

Fig. 3: Below, air distribution system for area A cells, envelope zone and grating test room. Return air tunnel serves to stabilize temperatures.



than mix with the room air.

All return and outside air from Area A then passes through air conditioning unit A-1 where it is filtered, simultaneously cooled and dehumidified and reheated by primary and secondary HW reheat coils.

Air is then conveyed through ducts to the six zones in Area A, reheated with electric heating elements to respective temperatures, and delivered without benefit of ductwork directly to perforated ceiling air distribution plenums. The grating test area located conveniently above the return air tunnel conveys air through short return air duct stubs at floor level, directly to the tunnel.

The envelope zone, which is next to the tunnel excavation, passes a mixture of return air from cells and envelope zone to tunnel through grilles located at floor level.

Approximately 16 percent minimum outside air is required to make up air exhausted and to maintain a slight pressure in the B-C Area. The air conditioning system incorporates automatic summer-winter changeover control, utilizing chilled water coils to cool and dehumidify air during the cooling season, and outside air, or a mixture of return and outside air to offset internal heat gains during the normal heating season. The space above the suspended ceiling in B Area is used to convey return air, or relief air as required back to the fan room. Return air from the C Area located next to the fan room enters the fan room directly through grilles and mixes with return air from B Area.

Relief Dampers

Relief dampers located in the fan room are used to relieve pressure built up as outside air requirements exceed minimum requirements. Air passing through this unit gets filtered and reheated in addition to cooling and dehumidification when required. The supply air at this primary temperature is then conveyed via ductwork to the various zones involved and reheated with hot water coils to final zone delivery temperature. Actual delivery of air within the B-C Area is through conventional grilles.

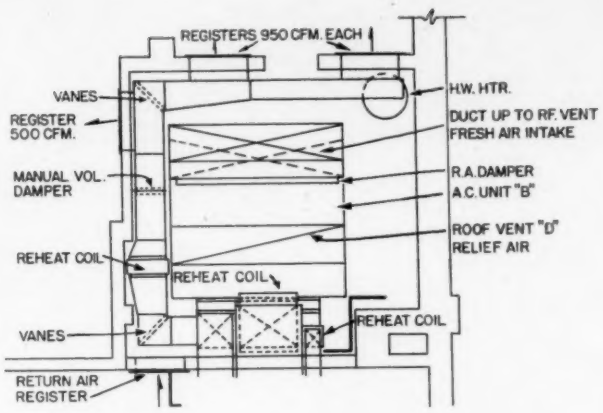


Fig. 4: This air handling unit is used to serve some of the non-critical areas in the lab.

Fortunately the additional complications associated with the simultaneous close control of humidity and temperature did not have to be dealt with. A not-to-exceed maximum in lieu of a controlled constant humidity was specified in the preliminary survey of requirements. This permitted the air conditioning apparatus to be utilized for the basic thermodynamic function of simultaneously cooling and dehumidifying to a pre-determined maximum wet bulb, while performing the prime function of temperature reduction to offset gains and maintain a controllable difference in dry bulb temperature.

The control sequence maintaining the ultra-precise .01° temperature in the four ruling engine cells or rooms is as follows:

Cooling coil controls: Just after the return air passes over the cooling coil its temperature is felt by a 1000 ohm nickel element located at the fan discharge into the plenum. This temperature is compared with the set point temperature (60.0° F) in an amplifier detector which produces a signal proportional to the error. The error signal is then fed to a C.A.T. control unit where a computation takes place to convert the error into a 0 to 5 ma control signal. The control signal is then fed to an electro-pneumatic converter where it is converted to an air signal within the range of 3 to 13 psi. The air signal then is available at the valve actuator to change the water valve position.

The same error signal produced in the detector amplifier is fed to one point of a nine-point recorder

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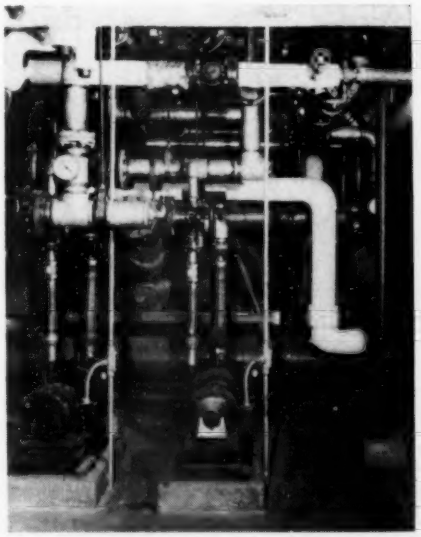


Fig. 5: Above, water chillers and pumps in equipment room next to critical engine ruling cells.

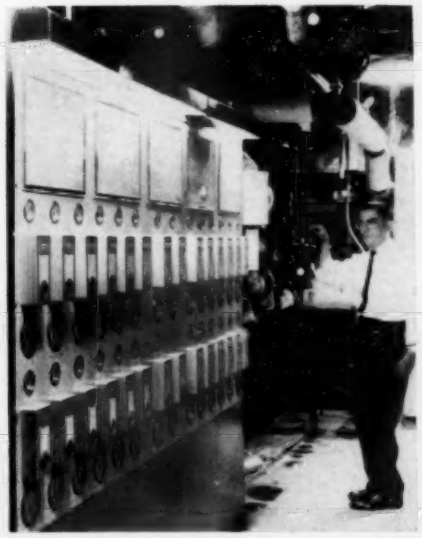
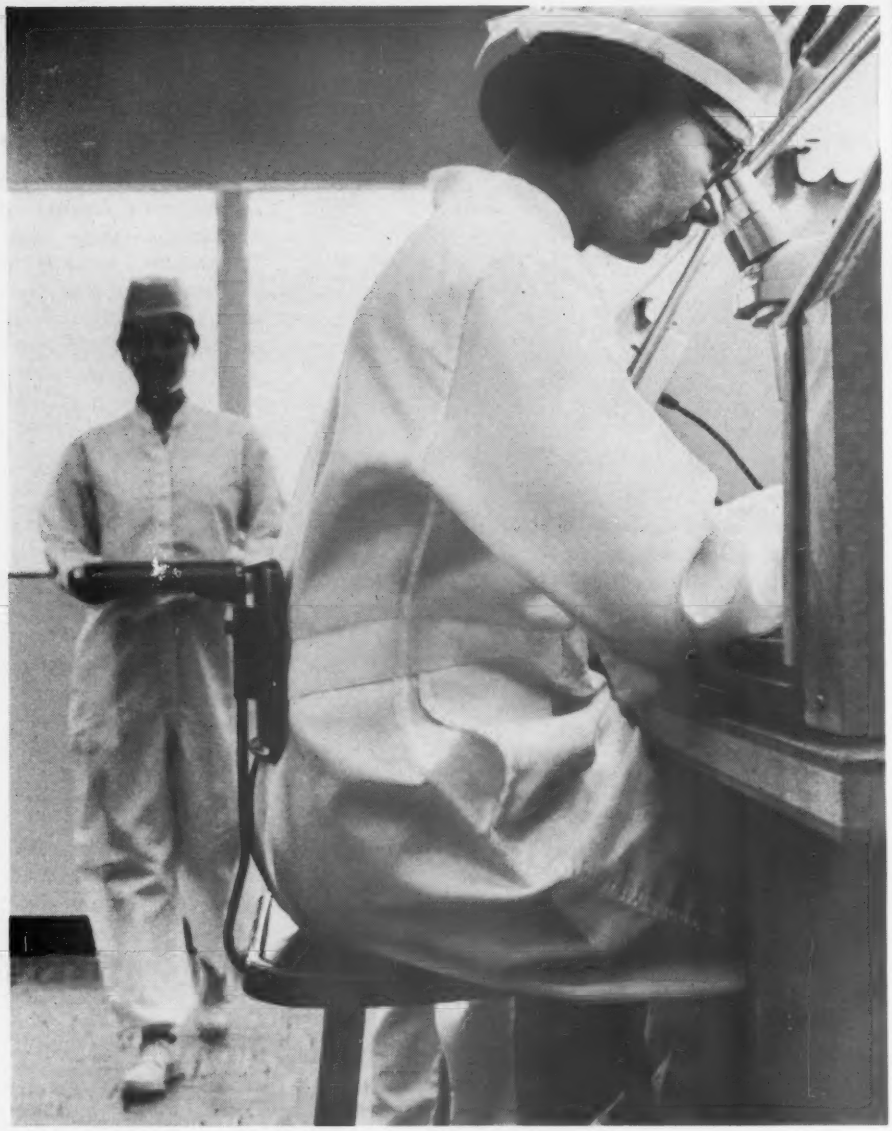


Fig. 6: Temperature control, recording instruments are viewed by Michael Pena, B&L engineer.



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(Continued from preceding page)

which displays the difference between actual temperature in the duct and desired temperature (60.0°F). This recorded temperature error is readable to 0.01°F.

1st reheater controls: This part of the system is the same as described under cooling coil controls except that the sensing element is located in the duct just downstream from the 1st reheater coil and the set point temperature is 61.5°F.

2nd reheater controls: This part of the system is the same as described under cooling coil controls except that the sensing element is located in the 5000 cfm duct to the four cells just downstream from the 2nd reheater coil and the set point temperature is 64.0°F.

Engine Cell Controls: The incoming air to the cells from the above 2nd reheater coil passes over an electric strip or grid heater located in the duct. Immediately downstream from the heaters, and located to avoid direct radiation from the heaters, is a 1000 ohm nickel element which senses the supply air to each cell. This temperature is fed to an amplifier detector where it is compared with the set point temperature fed to the detector from a set point unit. An error is established from this comparison and that error signal is fed to a C.A.T. control unit which computes a control signal of 0 to 5 ma. The control signal drives a magnetic amplifier-saturable core reactor package which in turn powers the electric heaters to eliminate the error.

Error Control

Located in the cell, on a 12 ft. lead is another 1000 ohm nickel element which feels the temperature at its particular location and feeds its signal to a detector amplifier. The detector amplifier compares this temperature to 68.0°F and feeds the error to one point of a nine-point recorder. The recorder prints this error on a chart to a readable accuracy of ± 0.01°F.

The error signal generated by the difference in the temperature between that felt by the element in the cell and 68°F is also fed to a P.A.T. control unit, the output

of which acts through appropriate switching to reposition the set point of the inlet air temperature control.

This system applies to each of the four engine cells.

Envelope area controls: The controls for the envelope area are the same as for the cells except that instead of one element being located in the room, there are ten. The outputs of these ten elements are averaged to give a more representative reading.

Grating test room controls: The test room controls are the same as for the envelope test area except that the controlled temperature can be varied between 68°F and 74°F. The control measurement is made using one element instead of a series arrangement as in the envelope area.

The systems maintain the specified temperatures within the limits of ± 0.01°F in the cells and ± 0.25°F in the envelope area and in grating test when the temperatures of cooling water to the cooling coil circulating systems and heating water to the reheat coil recirculating systems are maintained within limits of ± 0.5°F by apparatus and control systems.

Filtration requirements for the A or critical area can be categorically established as upper range medium efficiency effective against 2-5 micron particles. The relative lack of activity per square foot, control over housekeeping within the area and filtered outside air intake, would permit operation without pre-filters, however holding frames for low efficiency high loading panel type pre-filters were included in the installation.

With the exception of the Cementing Room for which fine filtration was provided, Area B and C filtration requirements were specified generally as non-critical from the particle size standpoint. As a result viscose impingement filters in the upper range low efficiency category were selected. Good control of housekeeping will supplement filtration to provide required cleanliness.

Two identical 27-ton package water chillers consisting of prewired control panels, condensers,

(Please turn to page 56)

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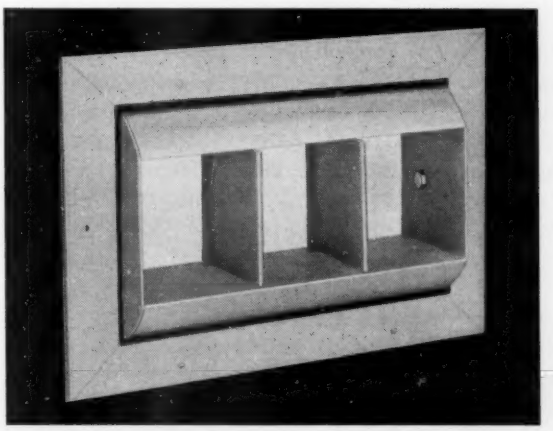

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How to prevent employee exposure to health hazards by . . .

Correct Ventilation Design For Transfer Of Liquid Materials

Whether you move liquids from storage to process by gravity, suction, pressure or pump, you can avoid risk of toxic fumes by proper ventilation as shown here.

By William V. Andresen
Chief Industrial Hygienist
American Cyanamid Co.

THE transfer of volatile liquid materials from containers or storage tanks in chemical processing may present employee exposure if the vapors are irritating or toxic.

There are four methods in which liquids are transferred to process equipment:

1. Gravity
2. Suction
3. Pressure by air or other gases
4. Pump

Transfer by gravity is accomplished by locating the storage tank or container above the equipment into which the transfer is to be made.

Transfer from storage tanks can usually be done in a closed system with resulting vapors vented outside of the work area.

Transfer of liquid from drums or carboys, however, is often done directly into equipment openings such as manholes. This type of operation may be accompanied by the exposure of the employee to vapors from the liquid charged or to toxic or irritating gas mist or vapors from chemical reaction within the reaction vessel.

Control of these evolutions from reaction vessels may be realized by the use of draw through, hood enclosure or slot type ventilation. These ventilation techniques were described in a previous article on ventilation of tanks, tubs and kettles, (Aug. 1960, p.34).

Care must be taken to insure that the liquid is discharged within the area controlled by the ventilation system.

Tranfer of liquid by suction from storage tanks to process equipment usually presents no employee exposure as the equipment system is closed and both the storage tank and reaction vessel may be vented outside of the work area.

Suction transfer from drums or other small containers, however, may present exposure to irritating or toxic materials due to leakage during insertion or removal of the suction leg from the container or from evaporation of the material from the suction leg when it is removed. Control of these vapors may be accomplished by hood enclosure of the container as is shown in Fig. 1. Any spills will be contained within the enclosure. Evaporation of material from the suction leg will occur within the hood enclosure and, therefore, will be under control. Openings of the hood may be kept small to limit the control air volume requirement. A control velocity of 100 fpm across the hood opening will usually provide satisfactory control.

Fig. 2 shows a ventilation design which has proved to work effectively in the control of vapors evolved during transfer of material by suction from drums and carboys. The suction dip leg is located within a section of flexible fabric or rubber ductwork which is attached to an exhaust system. During transfer and operations, the flexible duct is contracted. When the suction leg is removed, the flexible ductwork expands and controls the evaporation of liquid remaining on the suction leg. A small air volume approximately 100 cfm will usually provide satisfactory control.

Transfer of material by air pressure from storage tanks will not ordinarily present exposure problems as a closed transfer system can be utilized. If, however, it is necessary for any reason to transfer liquid into a reaction vessel with an open manhole, it may be necessary to provide sufficient mechanical ventilation to control the release of air under pressure when the transfer operation has been completed. Control may be realized by the use of draw

(Please turn to page 56)

WILLIAM ANDRESEN is chief industrial hygienist for the American Cyanamid Co. A graduate engineer, he is vice chairman of the Bergen County, New Jersey air pollution control committee. He is also a delegate from the National Safety Council to the American Standards Association committee Z-9 on industrial ventilation. He is a member of the American Industrial Hygiene Association.

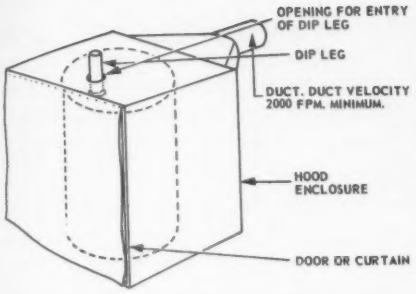


Fig. 1: Hood enclosure for control of vapor during liquid drum transfer. Use 100 fpm across hood face.

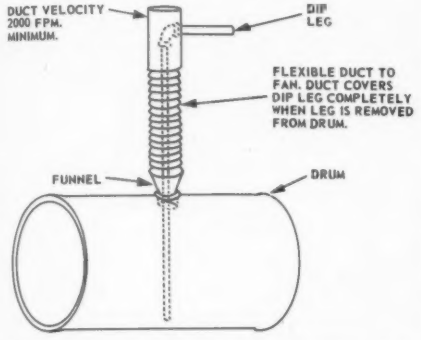

DUCT VELOCITY 2000 FPM. MINIMUM.
DIP LEG
FLEXIBLE DUCT TO FAN. DUCT COVERS DIP LEG COMPLETELY WHEN LEG IS REMOVED FROM DRUM.
FUNNEL
DRUM

Fig. 2: Flexible duct enclosure for control of gas and vapor dip leg pumping. Use 100 cfm in duct.

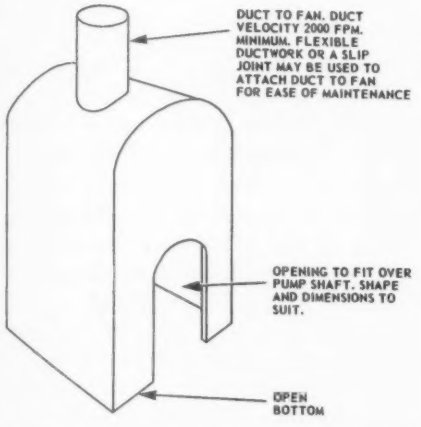

DUCT TO FAN. DUCT VELOCITY 2000 FPM. MINIMUM. FLEXIBLE DUCTWORK OR A SLIP JOINT MAY BE USED TO ATTACH DUCT TO FAN FOR EASE OF MAINTENANCE
OPENING TO FIT OVER PUMP SHAFT. SHAPE AND DIMENSIONS TO SUIT.
OPEN BOTTOM

Fig. 3: Hood enclosure to control vapor from pump packing gland leakage. 100 cfm will give control.

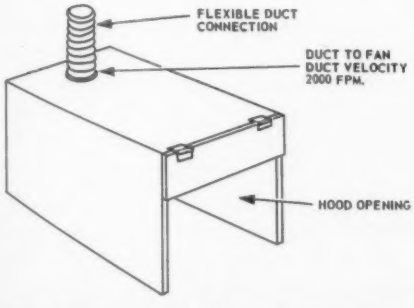
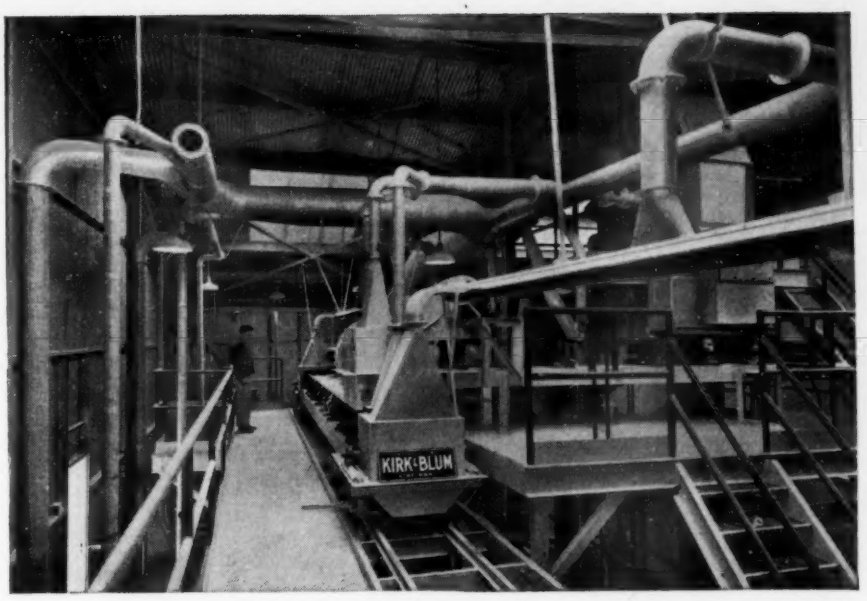


Fig. 4: Enclosure over small pumps for gas and vapor control from the packing glands.



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Dust Control
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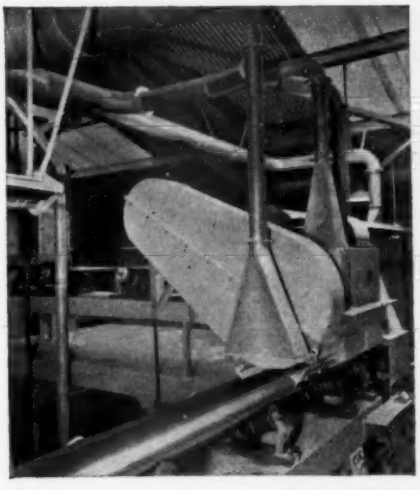
Plant-wide system keeps air clean

At every point where there is danger of dust being created or escaping into the plant, modern streamlined hoods and ducts are provided, all connected to a central system, powered by a 50 HP motor, capable of handling 25,000 CFM.

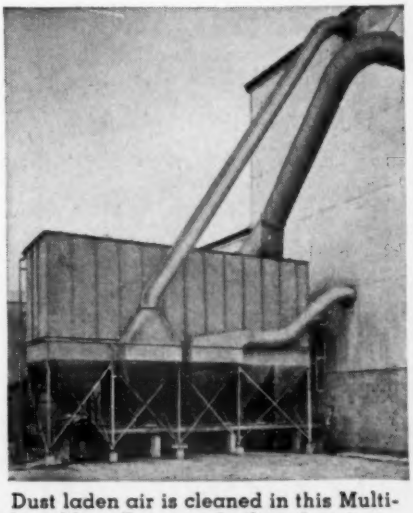
Hoods and ducts are placed out of the working area. The system collects air containing silica dust created in the processing of raw silica rock, draws it to a filter, cleans the air, and returns the collected material to bins as a product component.

Waste is eliminated and plant working conditions are kept at a level assuring greater worker productivity.

The complete installation was designed, fabricated and installed by The Kirk & Blum Manufacturing Company, Cincinnati. Information concerning Kirk & Blum Dust Collection Systems may be secured by writing to the company at 3130 Forrer Street, Cincinnati 9, Ohio.



Hoods and ducts are located so as not to interfere with working areas. Keeping plant air clean safeguards workers.



Dust laden air is cleaned in this Multibag filter. Recovered silica dust is returned to mixers for re-use.

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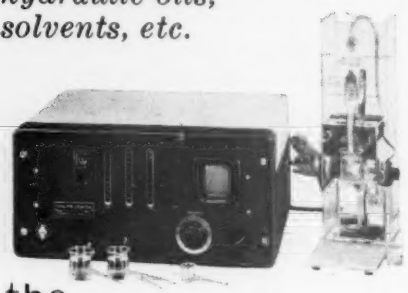

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10.0	541
7.5	1400
5.0	4.554
4.0	9300
3.0	24,800
2.3	60,000
1.5	245,000
.9	1,570,000

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[Circle #41 on page 61]

Community Cases of Berylliosis

(Continued from page 32)

stitutes of Health grant, an extensive sampling program was initiated in 1958. Five hundred 48-hour high-volume samples were collected in the first phase of the study. The mean concentration of beryllium in the area of the plant was 0.015 micrograms per cubic meter of air. The second sampling phase has not been completed but preliminary evaluations indicate that samples about the suggested maximum allowable threshold limit of 0.01 micrograms per cubic meter of air have been found on frequent occasions even at a considerable distance from the plant. This would seem to confirm the tentative value of 0.01 micrograms maximum allowable concentration, postulated by Eisenbud, as a desirable maximum allowable concentration.

A two-week vacation shut-down of the plant during the sampling period resulted in a greatly reduced value of 0.0015 micrograms of beryllium per cubic meter of air for the mean concentration and added further towards confirmation of the beryllium plant as the main source of the air pollution.

Lung Studies of Residents From the Community

Neighborhood contamination of the air is reflected in the beryllium content of lung tissue of the general population of the area.

The lungs of a number of residents, who lived in the neighborhood of the beryllium refinery and had no symptoms of disease but died of various non-related illnesses, have been qualitatively analyzed for beryllium. Beryllium was found in all samples in varying quantities. In each case there was much more beryllium in the lungs than in the lungs of persons from a control area where there was no beryllium plant[6].

The fact that beryllium was also found in smaller quanties in areas where there is no beryllium industry activity is due to the fact that fossil fuels contain measurable amounts of beryl which appear in the ashes and are inhaled. Persons who worked inside the plant and who also had no beryllium disease showed levels up to 100 times of those of persons from the community surrounding the beryllium plant.

Quantitatively, the amount of beryllium in the lungs of residents of the area who did not die from beryllium disease does not seem to vary from those who died from the disease, or who had biopsy specimens taken. The same factors apply to urinary excretion. Persons who have been exposed to high occupational beryllium concentrations excrete beryllium in their urine irrespective of whether they have the disease or not.

The finding of beryllium in lungs or in urine is merely evidence of exposure and not the diagnostic criterion of disease.

Discussion

The pathological picture and the course of the disease caused by community air contamination is identical with the picture of chronic occupational berylliosis.

Despite extensive search no more than 37 cases have been documented in a potentially exposed population of approximately 150,000 persons over a period of 25 years in the United States. The one documented case from the fluorescent lamp industry lived within 100 yards of the plant. The Ohio cases occurred within a radius of one mile from the plant.

The 26 cases from Pennsylvania follow a different pattern. Most of them occurred within three to five miles of the plant.

There has been little or no air sampling performed during the actual time of exposure in all three groups.

The Ohio air sampling data are scanty and cover a period of only ten weeks with few samplers operating.

Fifteen high-volume samples were taken at the site of the Pennsylvania plant in 1948 and concentrations ranged from three micrograms of beryllium per cubic meter at 0.15 miles from the plant to 0.001 micrograms at two miles from the plant. The 1958-59 samples, which were taken many years after the initial exposure of the majority of the cases, were

much lower than the earlier samples and reflect the efforts of the plant to control air pollution.

When we spread the 26 cases over a period of 12 years we find that in an exposed population of over 100,000 persons we have approximately 2.1 cases per year. Even though this may appear to be a low incidence, there are many other diseases with a similar incidence. The question naturally arises as to what singles out these people. Why are they affected and not others? To date there is no satisfactory answer to this question. Sensitization to compounds of beryllium is still the favorite unconfirmed theory.

Persons occupationally exposed have been subjected to much higher concentrations and the incidence in this group has been much greater. From approximately 4,000 occupationally exposed persons in one group we have learned of 21 cases of chronic berylliosis. Here the incidence of those exposed is 0.5% as opposed to 0.00016% in the community cases.

With a latent period of several years between the actual exposure and the onset of symptoms it is impossible to establish a time or quantitative dose relationship.

There have been cases of chronic berylliosis in individuals who worked for only a few weeks in a beryllium plant and several years later showed typical symptoms of chronic beryllium disease. Here the time relationship can be established only where the patient lived in an area away from the plant where beryllium air contamination was absent. If he lived close to the plant he would be subjected not only to his occupational exposure but also to community air contamination after he left his work.

Summary and Conclusion

Chronic beryllium disease occurs in a small fraction of those exposed to low concentrations of beryllium and its compounds. The reason some persons are affected and not others remains unknown in spite of extensive studies of the few groups noted in this paper.

Information on three studies of chronic beryllium disease are reported.

(Please turn to following page)

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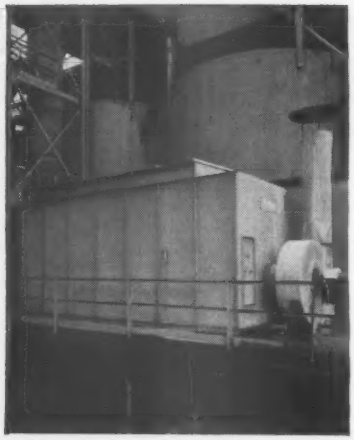
[For more information circle #42 on page 61 reply cards]



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[For more information circle #57 on page 61 reply cards]

Berylliosis

(Continued from preceding page)

Several cases occurred as far away as five miles from the plant where the concentration of air contamination with beryllium was definitely near or below the presently accepted outdoor maximum allowable concentration of 0.01 micrograms per cubic meter of air. In view of this fact the presently accepted maximum allowable concentration should be kept until more information has been obtained about this disease.

REFERENCES

(1) Gellman: Poisoning by vapors of Beryllium Oxy-fluoride, *Journal Industrial Hygiene,* 1936, vol. 18. p. 37.

(2) Louis McCabe, *Air Pollution, McGraw-Hill,* Chapter 56, by Irving Tabershaw, p. 469, 470.

(3) Merrill Eisenbud, Wanta, et el., *Journal of Industrial Hygiene and Toxicology,* 31: No. 5, September 1949.

(4) Lieben, J., Metzner, Epidemiological Findings Associated with Beryllium Disease, *Journal of Industrial Hygiene,* Vol. 20, No. 6, Dec. 1959, p. 494.

(5) Sussman, V. H., Lieben, J., Cleland, J. G., An Air Pollution Study of a Community Surrounding a Beryllium Plant, *Journal of Industrial Hygiene,* Vol. 20, No. 6, Dec. 1959, p. 504.

(6) Chamberlin, G. W., Jennings, W. P., Lieben, J., Chronic Pulmonary Disease Associated with Beryllium Dust, *Penna. State Medical Journal,* April 1957, Vol. 60, page 497-503.

Use the Communications Center, page 61, to receive more information about any product advertised, any new literature or new product described. Circle the number on the postage-free card that refers to the item of your interest, add your name and address and mail.

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PRODUCT LISTING
DIRECTORY OF SUPPLIES AND EQUIPMENT FOR CONTAMINATION CONTROL

(White Rooms, Super-Clean Rooms, Gray Rooms And Dust-Sensitive Areas)

How to use this Directory . . .

Products are listed in alphabetical order insofar as it is practical, under the name which in our opinion is most commonly used. You can find the product for which you are looking by checking first the category under which it falls, then the product listing. Then check the alphabetical listing of manufacturers for complete name and address of the supplier. While every effort has been made to insure accuracy of listings, the publisher is not responsible for any errors herein. We will be glad to make corrections in future directories.

ALARMS

Contamination Concentration

Foxboro Co., The
Lundell & Co.
Mine Safety Appliances Co.
Moore & Hanks Co.
National Spectrographic Labs.
Photobell Co., Inc.
Powers Regulator Co., The
Rett Electronics, Inc.
Royco Instruments, Inc.
Waber Electronics, Inc.

Door Interlock

Auto-Control Laboratories, Inc.
Betts & Betts Corp.
Challenger Lock Co.
Folger Adam Co.
Lundell & Co.
Moore & Hanks Co.
Photobell Co., Inc.
Powers Regulator Co., The

Filter Gauge

Dwyer Mfg. Co., F. W.
Ellison Draft Gage Co., Inc.
General Controls Co.
Lundell & Co.
Meriam Instrument Co., The
Mine Safety Appliances Co.
Moore & Hanks Co.
Pall Corp.
Photobell Co., Inc.
Powers Regulator Co., The

Humidity Control

Abrax Instruments Corp.
Auto-Control Laboratories, Inc.
Barber-Colman Co.
Foxboro Co., The
General Controls Co.
Humidifier & Ventilating Co., Inc., R. I.
Johnson Service Co.
Labline, Inc.
Lundell & Co.
Minneapolis-Honeywell Regulator Co.
Moore & Hanks Co.
Photobell Co., Inc.
Powers Regulator Co., The
Taylor Instrument Co.
United Electric Controls Co.

Static Pressure

Barber-Colman Co.
Dwyer Mfg. Co., F. W.
Ellison Draft Gauge Co., Inc.
Foxboro Co., The
General Controls Co.
Johnson Service Co.
Lundell & Co.
Meriam Instrument Co., The
Minneapolis-Honeywell Regulator Co.
Moore & Hanks Co.
Powers Regulator Co., The
United Electric Controls Co.
United States Gauge Div.
Waber Electronics, Inc.

CLOTHING

Bootees

Angelica Uniform Co.
Atlas Coverall & Uniform Supply Co.
Baronn's Professional Apparel
Blue Star Knitting, Inc.
Factory Apron & Towel Supply
Fashion Seal Uniforms
Milburn Co.
Mine Safety Appliances Co.
Plasticsmith, Inc.
Prudential Overall Supply
Reliable Linen Service
Shane Uniform Co., Inc.
Victor Gloves, Inc.
Worklon, Inc.

Component Wiping Cloths

Angelica Uniform Co.
Atlas Coverall & Uniform Supply Co.
Factory Apron & Towel Supply
Fashion Seal Uniforms
Mahler Co., Inc., H.
Prudential Overall Supply
Reliable Linen Service
Victor Gloves, Inc.
Worklon, Inc.

Gloves

Angelica Uniform Co.
Atlas Coverall & Uniform Supply Co.
Bearing Inspection, Inc.
Factory Apron & Towel Supply
Fashion Seal Uniforms
Mahler Co., Inc., H.
Milburn Co.
Mine Safety Appliances Co.
Plasticsmith, Inc.
Prudential Overall Supply
Reliable Linen Service
Shane Uniform Co., Inc.
Standard Glove Co. of New Jersey, Inc.
United States Rubber Co.
Victor Gloves, Inc.
Worklon, Inc.

Hats

Angelica Uniform Co.
Atlas Coverall & Uniform Supply Co.
Factory Apron & Towel Supply
Fashion Seal Uniforms
Milburn Co.
Mine Safety Appliances Co.
Plasticsmith, Inc.
Prudential Overall Supply
Reliable Linen Service
Shane Uniform Co., Inc.
Victor Gloves, Inc.
Worklon, Inc.

Laundering Service (Washing, Packing Under Dust Controlled Conditions)

Atlas Coverall & Uniform Supply Co.
CAEMCO
Detroit Overall Mfg. Co.
Factory Apron & Towel Supply
Fashion Seal Uniforms
Hoffman International Corp.
Prudential Overall Supply
Reliable Linen Service

Uniforms

Angelica Uniform Co.
Atlas Coverall & Uniform Supply Co.
Baronn's Professional Apparel
Detroit Overall Mfg. Co.
Factory Apron & Towel Supply
Fashion Seal Uniforms
Milburn Co.
Mine Safety Appliances Co.
Mitchell-Malthy Co.
Prudential Overall Supply
Reliable Linen Service
Shane Uniform Co., Inc.

(Please turn to following page)

(Continued from preceding page)

Victor Gloves, Inc.
Worklon, Inc.

CONTAMINATION MONITORING DEVICES

Air Flow Monitor

Waber Electronics, Inc.

Air Samplers, Electronic

Anderson Samplers & Consulting Service
Gelman Instrument Co.
Mine Safety Appliances Co.
Monitron Co., The
National Spectrographic Labs
Photobell Co., The
Rett Electronics, Inc.
Staplex Co., The
Union Industrial Equipment Corp.
Waber Electronics, Inc.

Air Samplers, Mechanical

Anderson Samplers & Consulting Service
Beckman Instruments, Inc.
Gelman Instrument Co.
Hydraulic Research & Mfg. Co.
Millipore Filter Corp.
Mine Safety Appliances Co.
Research Appliance Co.
Staplex Co., The
Union Industrial Equipment Corp.
Von Brand Filtering Recorders

Air Sterilization, Chemical

Easton R. S. Corp.

Air Sterilization, Ultraviolet Light

Atlantic Ultraviolet Co., Inc.
Cooper Hewitt Electric Co., Inc.
Fuller Co., D. William
Sampson Scientific Co.
Westinghouse Electric Corp., X-Ray Dept.

Dust Counters

Anderson Samplers & Consulting Service
Bausch & Lomb, Inc.
Coulter Industrial Sales Co.
Frommer, Joseph C.
Gelman Instrument Co.
Mine Safety Appliances Co.
Photobell Co., Inc.
Royco Instruments, Inc.
Union Industrial Equipment Corp.

Dust Particle Analyzers

Anderson Samplers & Consulting Service
Coulter Industrial Sales Co.
Gelman Instrument Co.
Hudson Automatic Machine & Tool Co.
Mine Safety Appliances Co.
National Spectrographic Labs
Nuclear Measurements Corp.
Rett Electronics, Inc.
Royco Instruments, Inc.
Union Industrial Equipment Corp.

Dust Particle Control System

CRS Industries, Inc.

Filters, Glass

Gelman Instrument Co.
Millipore Filter Corp.

Filters, Membrane

Gelman Instrument Co.

Liquid Media Contamination Monitoring Devices

Analytical Measurements, Inc.
(Recording pH Meter)
Bearing Inspection, Inc.
(Bearing Cleaning Machines, Bearing Analyzer, Filtered Cleaning Solvents, Filtered Grease Package In Hypodermic Syringes, Kit For Filtering Oils)
Cahn Instrument Co.
(Balances For Gravimetric Filter Methods With Liquids And Gases)
Coulter Industrial Sales Co.
(Electronic, 0.3 Of Micron Thru 300 Microns)
Horkey-Moore Associates
Mine Safety Appliances Co.
(Infrared Type)
Photobell Co., Inc.
(Photoelectric)
Royco Instruments, Inc.
(Analytical Nephelometer)

COVERINGS & FINISHES

Ceilings

Alumiseal Corp.
(Zero Perm Vapor Barrier Material And Board)
Cement Enamel Development, Inc.
(Flexon, Flexible: Fluid Tile A-16, Rigid)
Corrosion Control Co., Inc.
(Vinyls, Hypalon, Epoxies)
du Pont de Nemours & Co., E. I.
(Hypalon)
Glidden Co., The
(NuPon—Cote Coating S)
Hansson, Inc., Elof
(Hansoflow Vent-Spline System)
Moore & Hanks Co.
(Astro-Lab Ultra Seal Vinyl Covering)
Mirawal Div.
(Laminated Porcelain Enamel On Steel Building Panels)
United States Stoneware Co., The
(Tygoflex Plastic Coated Metal)
United Lighting & Ceiling Co.
(Luminous, Plastic)

Floors

Alumiseal Corp.
(Zero Perm Vapor Barrier Material)
Ceilcote Co., Inc., The
(Reinforced Plastics Of Polyester Glass Reinforced, Or Epoxy Glass Reinforced Construction)
Cement Enamel Development, Inc.
(Fluid Tile, A-12, Rigid)
Congoleum-Nairn, Inc.
(Static Conductive Linoleum)
Corrosion Control Co., Inc.
(Hypalon, Epoxy)
du Pont de Nemours & Co., E. I.
(Hypalon)
Glidden Co., The
(NuPon-Cote & Dado Enamel)
Mine Safety Appliances Co.
(Polyurethane Resin)
Minnesota Mining & Mfg. Co.
(3M Brand Strippable Coating EC-1220)
Speco, Inc.
(Rubber Base Paints)
United States Stoneware Co., The
(Tygoflex Plastic Coated Metal)

Walls

Alumiseal Corp.
(Zero Perm Vapor Barrier Material & Board)
Ceilcote Co., Inc., The
(Reinforced Plastics Of Polyester Glass Reinforced, Or Epoxy Glass Reinforced Construction)
Cement Enamel Development, Inc.
(Flexon, Flexible: Fluid Tile A-16 & A-17, Rigid)
Corrosion Control Co., Inc.
(Vinyl, Hypalon, Epoxy)
du Pont de Nemours & Co., E. I.
(Hypalon)
Glidden Co., The
(NuPon-Cote Coatings)
Minnesota Mining & Mfg. Co.
(3M Brand Strippable Coating EC-1220)
Mirawal Div.
(Laminated Porcelain Enamel On Steel Building Panels)
United States Stoneware Co., The
(Tygoflex Plastic Coated Metal)

Work Surfaces

Ceilcote Co., Inc., The
(Reinforced Plastics Of Polyester Glass Reinforced, Or Epoxy Glass Reinforced Construction)
Cement Enamel Development, Inc.
(Fluid Tile A-16 & A-17, Rigid)
Corrosion Control Co., Inc.
(Synthetic Rubber, Butyl, Neoprene Hypalon: Epoxies, Vinyls)
du Pont de Nemours & Co., E. I.
(Hypalon)
Glidden Co., The
(NuPon-Cote Coatings)
Minnesota Mining & Mfg. Co.
(3M Brand Strippable Coating EC-1220)
Mirawal Div.
(Laminated Porcelain Enamel On Steel Building Panels)
Speco, Inc.
(HEAT-REM H-120 & H-170 Heat Resistant Paint)
United States Stoneware Co., The
(Tygoflex Plastic Coated Metal)

ENCLOSURES

Dry Boxes

American Sterilizer Co.
Auto-Control Laboratories, Inc.
Baker Co., Inc.
Baker Instruments, Inc.

Blickman, Inc., S.
CAEMCO
General Acoustics Corp.
Gerwin Electronics, Inc.
Kewaunee Scientific Equipment
Moore & Hanks Co.
Packaged Laboratories Div.
Philco Corp.
Plastigage Corp.
Ray Products, Inc.
Sonic-Air Products, Inc.

Glove Boxes

Auto-Control Laboratories, Inc.
Baker Co., Inc.
Baker Instruments, Inc.
Blickman, Inc., S.
CAEMCO
Ceilcote Co., Inc., The
General Acoustics Corp.
Gerwin Electronics, Inc.
Kewaunee Scientific Equipment
Moore & Hanks Co.
Philco Corp.
Plastigage Corp.
Ray Products, Inc.
Sonic-Aire Products, Inc.

Inert Gas Boxes

Auto-Control Laboratories, Inc.
Baker Co., Inc.
Baker Instruments, Inc.
Blickman, Inc., S.
CAEMCO
Gerwin Electronics, Inc.
Kewaunee Scientific Equipment
Plastigage Corp.
Ray Products, Inc.
Sonic-Air Products, Inc.

Vacuum Boxes

Auto-Control Laboratories, Inc.
Baker Co., Inc.
Baker Instruments, Inc.
Blickman, Inc., S.
CAEMCO
Kewaunee Scientific Equipment
Gerwin Electronics, Inc.
Plastigage Corp.
Ray Products, Inc.

Ultrasonic Cleaning Boxes

Ultrasonic Industries, Inc.

FILTRATION DEVICES

Air, Activated Carbon

Connor Engineering Corp.

Air, Electronic Precipitator

Air Conditioning Engineering Co.
American Air Filter Co.
Burke & Co.
Dollinger Corp.
Electro-Air Cleaner Co., Inc.
Lennox Industries, Inc.
Mamco Corp.
Minneapolis-Honeywell Regulator Co.
Mueller Climatrol
Permatron Corp.
Radex Corp.
Trion, Inc.
Union Industrial Equipment Corp.
Westinghouse Electric Corp.,
Air Conditioning Div.
Westinghouse Electric Corp.,
Sturtevant Div.
York Corp.

Air, High Efficiency (Sub-Micron)

Air Conditioning Engineering Co.
Air Control, Inc.
Air Filter Corp.
Air-Maze Div.
Airgard Mfg. Co.
American Air Filter Co.
Baker Co., Inc.
Bearing Inspection, Inc.
Bendix Filter Div.
Cambridge Filter Corp.
Dollinger Corp.
Electro-Air Cleaner Co., Inc.
Farr Co.
Flanders Filter Co.
Gelman Instrument Co.
Gerwin Electronics, Inc.
Microtron Corp.
Mine Safety Appliances Co.
Mueller Climatrol
Pall Corp.
Permatron Corp.
Pullman Vacuum Cleaner Corp.
Radex Corp.
Sonic-Air Products, Inc.
Stoddard Industries
Trion, Inc.
Union Industrial Equipment Corp.

Air, Pre-Filter

Air Conditioning Engineering Co.
Air Filter Corp.
Air-Maze Div.
American Air Filter Co.
Bearing Inspection, Inc.
Bendix Filter Div.
Burke & Co.
Cambridge Filter Corp.
Carey Electronic Engineering Co.
Commercial Filter Corp.
Continental Air Filters, Inc.
Drico Industrial Corp.
Dollinger Corp.
Electro-Air Cleaner Co., Inc.
Evans Corp., The George
Farr Co.
Flanders Filters, Inc.
Gelman Instrument Co.
Mine Safety Appliances Co.
Owens-Corning Co.
Pall Corp.
Permatron Corp.
Pullman Vacuum Cleaner Corp.
Snow Filtration Co.
Sonic-Air Products, Inc.
Radex Corp.
Research Products Corp.
Stoddard Industries
Technical Filter Co.
Trion, Inc.
Union Carbide Development Co.
Vortox Co.

Gas

Air Filter Corp.
Air-Maze Div.
Bendix Filter Div.
Cambridge Filter Corp.
Commercial Filters Corp.
Dollinger Corp.
Engelhard Industries, Inc.
Gelman Instrument Co.
Mine Safety Appliances Co.
Pall Corp.
Snow Filtration Co.
Sonic-Air Products, Inc.
Universal Dynamics Corp.

Liquid

Air-Maze Div.
Bearing Inspection, Inc.
Bendix Filter Div.
Commercial Filters Corp.
Dollinger Corp.
Gelman Instrument Co.
General Filters, Inc.
Mine Safety Appliances Co.
Pall Corp.
Snow Filtration Co.
Ultrasonic Industries, Inc.

FURNITURE

Ajusto Equipment Co.
Baker Co., Inc.
Baker Instruments, Inc.
Controlled Environment, Inc.
Cramer Posture Chair Co.
Hamilton Mfg. Co.
Kewaunee Scientific Equipment
Leitch-Huard Corp.
Lyon Metal Products, Inc.
Moore & Hanks Co.
Royal Metal Mfg. Co.
Steelcase, Inc.
Tolerton Co., The

HARDWARE

Air Vacuum Pick-Up Nozzles

Air-Vac Engineering Co., Inc.
Central Vacuum Corp.
Kent Co., Inc., The
Moore & Hanks Co.
Spencer Turbine Co., The

Clothing Lockers, Garment Dispensers

Change-O-Matic Corp.
Lyon Metal Products, Inc.
Republic Steel Corp.

Door Closers

Challenger Lock Co.

Door Interlocks

Challenger Lock Co.
Edwards Co., Inc.
Folger Adam Co.
Moore & Hanks Co.
Mosler Safe Co.
Railway & Industrial Engineering
Stanley Works, The

Hinges

Moore & Hanks Co.
Stanley Works, The

Locking Devices

Challenger Lock Co.

Switches

Allen-Bradley Co.
Betts & Betts Corp.
Central Vacuum Corp.

(Please turn to following page)

(Continued from preceding page)

Challenger Lock Co.
Cutler-Hammer, Inc.
Moore & Hanks Co.
Square D Co.
Switchcraft, Inc.
United Electric Controls Co.

MAINTENANCE MATERIAL

Mops

Clean Tread Mat Div.
Factory Apron & Towel Supply
Prudential Overall Supply
Reliable Linen Service

Sponges

Factory Apron & Towel Supply
Reliable Linen Service
Simonize Co.

Vacuum Cleaners, Central System

Central Vacuum Corp.
Hoffman Industries, Inc.
Lamson Corp.
Spencer Turbine Co., The

Vacuum Cleaners, Portable

Ace-Sycamore, Inc.
Air-Vac Engineering Co., Inc.
Black & Decker Mfg. Co., The
Breuer Electric Mfg. Co.
Clean Tread Mat Div.
Clements Mfg. Co.
Electrolux Corp.
Hoffman Industries, Inc.
Hoover Co., The
Kent Co., Inc., The
Liberty Machine Co.
Pullman Vacuum Cleaner Corp.
Spencer Turbine Co., The

Wiping Rags

Factory Apron & Towel Supply
Fashion Seal Uniforms
Fulton Cotton Mills
Mahler Co., Inc., H.
Prudential Overall Supply
Reliable Linen Service
Star Tex Mills Co.
Victor Gloves, Inc.

MANUFACTURERS' AGENTS SPECIALIZING IN WHITE ROOM EQUIPMENT

Greiner Co., The Emil
20 -26 N. Moore St.
New York 13, N.Y.

Microclean Industries, Inc.
915 Great Plain Ave
Needham 92, Mass.

Miracle Mat Co., The
353 Washington St.
Winchester, Mass.

Specialties, Inc.
Skunks Misery Rd.
Syosset, Long Island, N.Y.

Tripp & Associates, David J.
18119 Rancho St.
Tarzana, Calif.

Warren & Associates, Fred C.
P.O. Box 75822 Sanford Station
Los Angeles, Calif.

Watkins Mechanicals, Inc.
1455 Miami Rd.
P.O. Box 10192
Jacksonville 7, Fla.

MATERIAL HANDLING EQUIPMENT

Baker Instruments, Inc.
(Assembly Tools, Bearing Handling Tweezers)
Central Vacuum Corp.
(Cleaning Hoses And Tools, Suction Controlled Bench Vacuum Attachment)
Hudson Automatic Machine & Tool Co.
("Projectina" For Dust Monitoring)
Lamson Corp.
(Automatic Pallet Loaders, Pre-Engineered And Complete Engineered Powered And Grautz Conveyors, Pneumatic Airtube System)
Lyon Metal Products, Inc.
(Cabinets, Storage Steel, Shelving)
Photobell Co., Inc.
(Conveyor Routing And Dispatching Automatically)
Research Products Corp.
(Rubber Mesh Matting, RP Neotex)

MECHANICAL EQUIPMENT

Air Conditioning (Packaged, Special For White Rooms)

Air Conditioning Engineering Co.
American Air Filter Co.
Auto-Control Laboratories, Inc.
CAEMCO
Carrier Air Conditioning Co.
Chrysler Corp.
Clarage Fan Co.
Dunham-Bush, Inc.
Dynamic Air Engineering
General Acoustics Corp.
Hupp Corp.
King Co.
Leitch-Huard Corp.
Lennox Industries, Inc.
Marlo Coil Co.
Moore & Hanks Co.
Packaged Laboratories Div.
Sonic-Air Products, Inc.
Surface Combustion Div.
Trane Co., The
Westinghouse Electric Corp., Air Conditioning Div.
Westinghouse Electric Corp., Sturtevant Div.
Worthington Corp.
York Corp.

Air Mixing Units, Sound & Volume Control

Air Devices, Inc.
Anemostat Corp. of America
Barber-Colman Co.
Buensod-Stacey Corp.
Buffalo Forge Co.
Carnes Corp.
Carrier Air Conditioning Co.
Clarage Fan Co.
Connor Engineering Corp.
Dunham-Bush, Inc.
Trane Co., The
Tuttle & Bailey Div.
Worthington Corp.
York Corp.

Air Showers

Air Conditioning Engineering Co.
Auto-Control Laboratories, Inc.
Baker Co., Inc.
Baker Instruments, Inc.
CAEMCO
General Acoustics Corp.
Moore & Hanks Co.
Packaged Laboratories Div.
Sonic-Air Products, Inc.
Spencer Turbine Co., The
Thermotank, Inc.

Boot, Sealing

Alasco Rubber & Plastics Corp.

Connectors, Rubber

Alasco Rubber & Plastics Corp.

Closed-Circuit Recirculating System For Inert Gases

Sonic-Air Products, Inc.
Universal Dynamics Corp.

Diffusers

A-J Mfg. Co.
Air Conditioning Engineering Co.
Air Control Products, Inc.
Air Guide Corp.
Anemostat Corp. of America
Auer Register Co.
Barber-Colman Co.
Benjamin Div.
Carnes Corp.
Connor Engineering Corp.
Engelhard Industries, Inc.
Lima Register Co.
Moore & Hanks Co.
Multi-Vent Div.
Sylvania Electric Products, Inc.
Thermotank, Inc.
Titus Mfg. Corp.
Tuttle & Bailey
Universal Diffuser Corp.

Ducts, Flexible, Metallic

Flexaust Co., The

Ducts, Flexible, Non-Metallic

Flexaust Co., The
Flexible Tubing Corp.

Duct Liners

Carpart Corp.
Ceilcote Co., Inc., The
Gustin-Bacon Mfg. Co.
Hansson, Inc., Elof
Moore & Hanks Co.
United States Stoneware Co., The

Duct Materials

Baker Instruments, Inc.
Barber-Colman Co.

Carnes Corp.
Carpart Corp.
Ceilcote Co., Inc., The
Dunham-Bush, Inc.
Gustin-Bacon Mfg. Co.
Haveg Industries, Inc.
Industrial Plastic Fabricators, Inc.
Moore & Hanks Co.
United Sheet Metal Co., Inc.
United States Stoneware Co., The

Grilles

A-J Mfg. Co.
Air Conditioning Engineering Co.
Air Guide Corp.
Auer Register Co.
Barber-Colman Co.
Carnes Corp.
Carpart Corp.
Connor Engineering Corp.
Lima Register Co.
Moore & Hanks Co.
Titus Mfg. Corp.
Tuttle & Bailey
United Sheet Metal Co., Inc.
Universal Diffuser Corp.

Humidity Control Equipment

Abrax Instruments Corp.
Air Conditioning Engineering Co.
Air Control, Inc.
American Air Filter Co.
Applied Pneumatics, Inc.
Auto-Control Laboratories, Inc.
Bahnson Co.
Barber-Colman Co.
Bryant Mfg. Co.
Clarage Fan Co.
Desomatic Products Div.
Dryomatic Corp.
Foxboro Co., The
General Controls Co.
General Filters, Inc.
Humidifier & Ventilating Co., Inc., R. I.
Johnson Service Co.
Kaufman Co., The H. J.
Marlo Coil Co.
Minneapolis-Honeywell Regulator Co.
Moore & Hanks Co.
Mueller Climatrol
Partlow Corp., The
Pittsburgh Lectrodryer Div.
Ray Products, Inc.
Research Products Corp.
Sonic-Air Products, Inc.
Surface Combustion Div.
Taylor Instrument Co.
Trerice Co., H. O.
United Electric Controls Co.
Walton Laboratories, Inc.
Westinghouse Electric Corp., Sturtevant Div.

Lighting

Auto-Control Laboratories, Inc.
Benjamin Div.
Betts & Betts Corp.
Crouse-Hinds Co.
Day-Bright Lighting, Inc.
Moore & Hanks Co.
Sylvania Electric Products, Inc.
United Lighting & Ceiling Co.
Westinghouse Lamp Div.
Worner Electronic Devices

Materials Testing Equipment

Custom Scientific Instruments, Inc.

Mechanical Cleaners

Currier Co.

Micro-Manipulators

Custom Scientific Instruments, Inc.

Registers

A-J Mfg. Co.
Air Conditioning Engineering Co.
Air Control Products, Inc.
Air Guide Corp.
Auer Register Co.
Barber-Colman Co.
Carnes Corp.
Connor Engineering Corp.
Lima Register Corp.
Titus Mfg. Corp.
Tuttle & Bailey
Universal Diffuser Corp.

Shoe Cleaners, Mechanical

Central Vacuum Corp.
Lamson Corp.
Liberty Machine Co.
Progressive Engineering Co.

Shoe Cleaning Mats

AtLos Mat Sales
Bingham's Son Mfg. Co., Sam'l
California Ink Co., Inc., The
Clean Tread Mat Div.
Liberty Machine Co.

Static Pressure Regulators

Cash Co., A. W.
Dwyer Mfg. Co., F. W.
Foxboro Co., The
Hays Corp.
Hagen Mfg.
Johnson Service Co.
Minneapolis-Honeywell Regulator Co.
Moore & Hanks Co.
Sonic-Air Products, Inc.
Taylor Instrument Co.
United Electric Controls Co.

Temperature Controls

Air Conditioning Engineering Co.
American Instrument Co., Inc.
Auto-Control Laboratories, Inc.
Barber-Colman Co.
Cash Co., A. W.
Cutler-Hammer, Inc.
Dillon & Co., Inc., W. C.
Engelhard Industries, Inc.
Fischer & Porter Co.
Foxboro Co., The
General Controls Co.
Hagen Mfg.
Hays Co.
Johnson Service Co.
Marlo Coil Co.
Minneapolis-Honeywell Regulator Co.
OPW-Jordon Div.
Partlow Corp., The
Sonic-Air Products, Inc.
Taylor Instrument Co.
Trerice Co., H. O.
Squires Co., The C. E.
United Electric Controls Co.

Ultrasonic Cleaners

Acoustica Associates, Inc.
American Sterilizer Co.
Baker Co., Inc.
Baker Instruments, Inc.
Blackstone Corp.
Branson Instruments, Inc.
Pall Corp.
Westinghouse Electric Corp., X-Ray Dept.
Ultrasonic Industries, Inc.

Ultrasonic Cleaning Chemicals

Detrex Chemical Industries, Inc.
du Pont de Nemours & Co., E. I.
General Chemical Div.
Pennsalt Chemicals Corp.
Ultrasonic Industries, Inc.
Union Carbide Development Corp.

WHITE ROOM FABRICATORS

Auto-Control Laboratories, Inc.
Baker Co., Inc.
Baker Instruments, Inc.
CAEMCO
Controlled Environment, Inc.
Dynamic Air Engineering
General Acoustics Corp.
Leitch-Huard Corp.
Moore & Hanks Co.
Packaged Laboratories Div.
Shielding, Inc.
Sonic-Air Products, Inc.
Spellman Engineering Corp.
Unistrut Products Co.

ALPHABETICAL LIST OF MANUFACTURERS OF CONTAMINATION CONTROL EQUIPMENT

A

A-J Mfg. Co.
3601 E. 18th St.
Kansas City 27, Mo.

Abrax Instruments Corp.
179-15 Jamaica Ave.
Jamaica 32, N. Y.

Ace-Sycamore, Inc.
413 De Kalb Ave.
Sycamore, Ill.

Acoustica Associates, Inc.
10400 Aviation Blvd.
Los Angeles 45, Calif.

Air Conditioning Engineering Co.
44 First St.
Cambridge 41, Mass.

Air Control, Inc.
450 Narberth Ave.
Narberth, Pa.

Air Control Products, Inc.
Coopersville, Mich.

Air Devices, Inc.
185 Madison Ave.
New York 16, N. Y.

(Please turn to following page)

(Continued from preceding page)

Air Filter Corp.
4554 W. Woolworth Ave.
Milwaukee 18, Wis.

Air-Maze Div.
Rockwell-Standard Corp.
25000 Miles Rd.
Cleveland 28, Ohio

Air & Refrigeration Corp.
439 Madison Ave.
New York 22, N. Y.

Air-Vac Engineering Co., Inc.
100 Gulf St.
Milford, Conn.

Airgard Mfg. Co.
362 W. Erie St.
Chicago 10, Ill.

AirGuide Corp.
275 N. W. 27th St.
Miami, Fla.

Ajusto Equipment Co.
515 Conneaut St.
Bowling Green, Ohio

Alasco Rubber & Plastics Corp.
287 El Camino Real
San Bruno, Calif.

Allen-Bradley Co.
136 W. Greenfield Ave.
Milwaukee 4, Wis.

Alumiseal Corp.
429 E. 53rd St.
New York 22, N. Y.

American Air Filter Co.
215 Central Ave.
Louisville, Ky.

American Instrument Co., Inc.
8030 Georgia Ave.
Silver Spring, Md.

American Sterilizer Co.
2424 W. 23rd St.
Erie, Pa.

Analytical Measurements, Inc.
585 Main St.
Chatham, N. J.

Andersen Samplers & Consulting Service
1074 Ash Ave.
Provo, Utah

Anemostat Corp. of America
25 West 43rd St.
New York 36, N. Y.

Angelica Uniform Co.
1429 Olive St.
St. Louis 3, Mo.

Applied Pneumatics, Inc.
740 Celfax Ave.
Kenilworth, N. J.

Atlantic Ultraviolet Co., Inc.
24-10 40th Ave.
Long Island City 1, N. Y.

Atlas Coverall & Uniform Supply Co.
1441 E. Adams Blvd.
Los Angeles 11, Calif.

AtLos Mat Sales
1069 Georgia St.
Los Angeles 15, Calif.

Auer Register Co., The
6600 Clement Ave.
Cleveland, Ohio

Auto-Control Laboratories, Inc.
5251 West Imperial Hwy.
Los Angeles 45, Calif.

B

Bahnson Co., The
1001 S. Marshall St.
Winston-Salem, N. C.

Baker Co., Inc.
106 Granite St.
Biddeford, Maine

Baker Instruments, Inc.
Chandler Airport, Box 597
Chandler, Ariz.

Barber-Colman Co.
1300 Rock St.
Rockford, Ill.

Baronn's Professional Apparel
404 St. Peter St.
St. Paul 2, Minn.

Bausch & Lomb, Inc.
Rochester 2, New York

Bearing Inspection, Inc.
3311 E. Gage Ave.
Huntington Park, Calif.

Beckman Instruments, Inc.
Scientific & Process Instruments Div.
2500 Harbor Blvd.
Fullerton, Calif.

Bendix Filter Div.
434 W. 12 Mile Rd.
Madison Heights, Mich.

Benjamin Div.
Thomas Industries, Inc.
207 E. Broadway
Louisville, Ky.

Betts & Betts Corp.
Pomperaug Rd.
Woodbury, Conn.

Bingham's Son Mfg. Co., Sam'l
364 9th St.
Jersey City 2, N. J.

Black & Decker Mfg. Co., The
Towson 4, Md.

Blackstone Corp.
1111 Allen St.
Jamestown, N. Y.

Blickman, Inc., S.
526 Gregory Ave.
Weehawken, N. J.

Blue Star Knitting, Inc.
1428 N. Farwell Ave.
Milwaukee, Wis.

Branson Instruments, Inc.
37 Brown House Rd.
Stamford, Conn.

Breuer Electric Mfg. Co.
5100 N. Ravenswood Ave.
Chicago 40, Ill.

Bryant Mfg. Co.
2020 Montcalm St.
Indianapolis, Ind.

Buensod-Stacey Corp.
45 W. 18th St.
New York 11, N. Y.

Buffalo Forge Co.
490 Broadway
Buffalo 4, N. Y.

Burke & Co.
2902 Hyde Park Blvd.
Los Angeles 43, Calif.

C

CAEMCO
(Controlled Atmosphere Enclosures Mfg. Co.)
P.O. Box 5864
1061 E. 8th St.
Jacksonville 7, Fla.

Cahn Instrument Co.
14511 Paramount Blvd.
Paramount, Calif.

California Ink Co., Inc., The
2939 E. Pico Blvd.
Los Angeles 23, Calif.

Cambridge Filter Corp.
738 E. Erie Blvd.
Syracuse 1, N. Y.

Carey Electronic Engineering Co.
Metal Wool Div.
1880 Clifton Ave.
Springfield, Ohio

Carnes Corp.
Verona, Wis.

Carpart Corp.
209 W. Exchange St.
Owosso, Mich.

Carrier Air Conditioning Co.
Carrier Parkway
Syracuse, N. Y.

Cash Co., A. W.
P.O. Box 551
Decatur, Ill.

Ceilcote Co., Inc., The
4832 Ridge Rd.
Cleveland 9, Ohio

Central Vacuum Corp.
3008 E. Olympic Blvd.
Los Angeles 23, Calif.

Challenger Lock Co.
2349 W. La Palma Ave.
Anaheim, Calif.

Change-O-Matic Corp.
1770 Second Ave.
New York 28, N. Y.

Chrysler Corp.
Airtemp Div.
1600 Webster St.
Dayton, Ohio

Clarage Fan Co.
One Clarage Place
Kalamazoo, Mich.

Clean Tread Mat Div.
Merit Paper & Chemical Corp.
57 Regent St.
Cambridge, Mass.

Clements Mfg. Co.
6650 S. Narragansett Ave.
Chicago 38, Ill.

Commercial Filters Corp.
2 Main St.
Melrose 76, Mass.

Congoleum-Nairn, Inc.
195 Belgrove Dr.
Kearny, N. J.

Connor Engineering Corp.
Shelter Rock Lane
Danbury, Conn.

Continental Air Filters, Inc.
P. O. Box 1647
Louisville 1, Ky.

Controlled Environment, Inc.
915 Great Plain Ave.
Needham 92, Mass.

Cooper Hewitt Electric Co., Inc.
732 Grand St.
Hoboken, N. J.

Corrosion Control Co., Inc.
Greenvale, Long Island, N. Y.

Coulter Industrial Sales Co.
2525 N. Sheffield Ave.
Chicago 14, Ill.

Cramer Posture Chair Co.
625 Adams
Kansas City 5, Kan.

Crouse-Hinds Co.
1347 Wolf St.
Syracuse 1, N. Y.

CRS Industries, Inc.
1405 Locust St.
Philadelphia 2, Pa.

Currier Co.
511 O'Neill Ave.
Belmont, Calif.

Custom Scientific Instruments, Inc.
541 Devon St.
Kearny, N. J.

Cutler-Hammer, Inc.
315 N. 12th St.
Milwaukee, Wis.

D

Day-Bright Lighting, Inc.
5403 Bulwer Ave.
St. Louis, Mo.

Desomatic Products Div.
Atlantic Research Corp.
Shirley Hwy. at Edsall Rd.
Alexandria, Va.

Detrex Chemical Industries, Inc.
14331 Woodrow Wilson
Detroit, Mich.

Detroit Overall Mfg. Co.
743 Beaubien St.
Detroit 26, Mich.

Dillon & Co., Inc., W. C.
14620 Keswick St.
Van Nuys, Calif.

Dollinger Corp.
17 Centre Park
Rochester 3, N. Y.

Drico Industrial Corp.
100 8th St.
Passaic, N. J.

Dryomatic Corp.
P. O. Box 591
715 N. Fayette St.
Alexandria, Va.

du Pont de Nemours & Co., E. I.
Wilmington 98, Del.

Dunham-Bush, Inc.
179 South St.
West Hartford 10, Conn.

Dwyer Mfg. Co., F. W.
P. O. Box 373
Michigan City, Ind.

Dynamic Air Engineering
100-B Waters Bldg.
Grand Rapids 2, Mich.

E

Easton R. S. Corp.
4907 Farragut Rd.
Brooklyn 3, N. Y.

Edwards Co., Inc.
Post Hill Rd.
Norwalk, Conn.

Electro-Air Cleaner Co., Inc.
Olivia & Sproul Sts.
McKees Rocks, Pa.

Electrolux Corp.
500 Fifth Ave.
New York 36, N. Y.

Ellison Draft Gage Co., Inc.
Chicago 6, Ill.

Engelhard Industries, Inc.
113 Astor St.
Newark, N. J.

Evans Corp., The George
121 37th St.
Moline, Ill.

F

Factory Apron & Towel Supply
3200 N. Figueroa
Los Angeles, Calif.

Farr Co.
2301 Rosecrans
El Segundo, Calif.

Fashion Seal Uniforms
63 New York Ave.
Huntington, N. Y.

Fischer & Porter Co.
Warminster, Pa.

Flanders Filters, Inc.
P. O. Box 718
Riverhead, N. Y.

Flexaust Co., The
100 Park Ave.
New York 17, N. Y.

Flexible Tubing Corp.
Guilford, Conn.

Folger Adam Co.
P. O. Box 1148
Joliet, Ill.

Foxboro Co., The
Foxboro, Mass.

Frommer, Joseph C.
1525 Teakwood Ave.
Cincinnati 24, Ohio

Fuller Co., D. William
3320 E. 75th St.
Chicago 49, Ill.

Fulton Cotton Mills
170 Boulevard Elsas, S. E.
Atlanta, Ga.

G

Gelman Instrument Co.
P. O. Box 118-E
Chelsea, Mich.

General Acoustics Corp.
12248 Santa Monica Blvd.
Los Angeles 25, Calif.

General Chemical Div.
Allied Chemical Corp.
40 Rector St.
New York 6, N. Y.

General Controls Co.
801 Allen Ave.
Glendale 1, Calif.

General Filters, Inc.
43800 Grand River Ave.
Novi, Mich.

Gerwin Electronics, Inc.
Sub. of Liverpool Industries
7-22 149th St.
Whitestone 57, N. Y.

Glidden Co., The
900 Union Commerce Bldg.
Cleveland, Ohio

Gustin-Bacon Mfg. Co.
210 W. 10th St.
Kansas City 5, Mo.

H

Hagen Mfg.
Barabus, Wis.

Hamilton Mfg. Co.
Two Rivers, Wis.

Hansson, Inc., Elof
711 Third Ave.
New York 17, N. Y.

Haveg Industries, Inc.
Plastics Park
Wilmington 8, Delaware

Hays Corp.
718 E. 8th St.
Michigan City, Ind.

Hoffman Industries, Inc.
Air Appliance Div.
103 Fourth Ave.
New York 3, N. Y.

Hoffman International Corp.
107 Fourth Ave.
New York 3, N. Y.

Hoover Co., The
Die Castings Div.
101 Maple St.
North Canton, Ohio

Horkey-Moore Associates
Div. of Houston Fearless Corp.
24660 S. Crenshaw Blvd.
Torrance, Calif.

Hudson Automatic Machine & Tool Co.
3710 Hudson Ave.
Union City, N. J.

Humidifier & Ventilating Co., Inc., R. I.
65 Landsdowne St.
Cambridge, Mass.

Hydraulic Research & Mfg. Co.
2835 N. Naomi St.
Burbank, Calif.

I

Industrial Plastic Fabricators, Inc.
Endicott St.
Norwood, Mass.

J

Johnson Service Co.
507 E. Michigan St.
Milwaukee 1, Wis.

K

Kaufman Co., The H. J.
13215 Roselawn Ave.
Detroit 38, Mich.

Kent Co., Inc., The
Canal & S. James Sts.
Rome, N. Y.

Kewannee Scientific Equipment
4055 Logan St.
Adrian, Mich.

King Co., The
902 N. Cedar St.
Owatonna, Minn.

L

Labline, Inc.
3070 West Grand Ave.
Chicago 22, Ill.

Lamson Corp.
Lamson St.
Syracuse 1, N. Y.

Leitch-Huard Corp.
Manchester, New Hampshire

Lennox Industries, Inc.
200 S. 12th Ave.
Marshalltown, Iowa

Liberty Machine Co.
598 Deming Rd.
Berlin, Conn.

Lima Register Co.
1790 N. Cable Rd.
Lima, Ohio

Lundell & Co.
P. O. Box 156
Mt. Prospect, Ill.

Lyon Metal Products, Inc.
43 Railroad Ave.
Aurora, Ill.

M

Mahler Co., Inc., H.
693 Broadway
New York 12, N. Y.

Mamco Corp.
532-542 Fourth St.
Racine, Wis.

Marlo Coil Co.
7100 S. Grand Ave.
St. Louis 11, Mo.

Meriam Instrument Co., The
10920 Madison Ave.
Cleveland 2, Ohio

Microtron Corp.
2136 South Blvd.
Box 2092
Charlotte, N. C.

Milburn Co.
3246 E. Woodbridge
Detroit 7, Mich.

Millipore Filter Corp.
Bedford, Mass.

Mine Safety Appliances Co.
201 N. Braddock Ave.
Pittsburgh 8, Pa.

Minneapolis-Honeywell Regulator Co.
2747 Fourth Ave., S.
Minneapolis 8, Minn.

Minnesota Mining and Mfg. Co.
Adhesives, Coatings & Sealers Div.
900 Bush Ave.
St. Paul 6, Minn.

Mirawal Div.
Birdsboro Corp.
Birdsboro, Pa.

Monitron Co., The
1815 Wilaray Ter.
Cincinnati 30, Ohio

Mitchell-Malthy Co.
212 Catherine St.
Ogdensburg, N. Y.

Moore & Hanks Co.
Astro-Lab Div.
9702 E. Rush St.
So. El Monte, Calif.

Mosler Safe Co.
320 Fifth Ave.
New York 1, N. Y.

Mueller Climatrol
Division of Worthington Corp.
2005 W. Oklahoma
Box 401
Milwaukee 1, Wis.

Multi-Vent Div.
The Pyle-National Co.
1334 N. Kostner Ave.
Chicago 51, Ill.

N

National Spectrographic Laboratories
6300 Euclid Ave.
Cleveland, Ohio

Nuclear Measurements Corp.
2460 N. Arlington Ave.
Indianapolis 18, Ind.

O

OPW—Jordan Div.
Dover Corp.
6013 Wiehe Rd.
Cincinnati 37, Ohio

Owens-Corning Co.
Newark, Ohio

P

Packaged Laboratories Div.
Agnew-Higgins, Inc.
8412 Standustrial St.
Stanton, Calif.

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(Continued from preceding page)

Pall Corp.
30 Sea Cliff Ave.
Glen Cove, N. Y.

Partlow Corp., The
259 Campion Rd.
New Hartford, N. Y.

Penn Meter Co.
4110 Haverford Ave.
Philadelphia 4, Pa.

Pennsalt Chemicals Corp.
3 Penn Center
Philadelphia 2, Pa.

Permatron Corp.
666 E. Kensington Rd.
Arlington Heights, Ill.

Philco Corp.
Lansdale Div.
Church Rd.
Lansdale, Pa.

Photobell Co., Inc.
12 East 22 St.
New York 10, N. Y.

Pittsburgh Lectrodryer Div.
P. O. Box 1766
Pittsburgh 30, Pa.

Plasticsmith, Inc.
P. O. Box 1071
Pittsburg, Calif.

Plastigage Corp.
915 E. South St.
Jackson, Mich.

Powers Regulator Co., The
3400 Oakton St.
Skokie, Ill.

Progressive Engineering Co.
712 Ottawa Ave.
Holland, Mich.

Prudential Overall Supply
6920 Bandini Blvd.
Los Angeles 22, Calif.

Pullman Vacuum Cleaner Corp.
25 Buick St.
Boston 15, Mass.

R

Radex Corp.
2076 Elston Ave.
Chicago 14, Ill.

Railway & Industrial Engineering
Equipment Div.
Greensburg, Pa.

Ray Products, Inc.
763 S. Palm Ave.
Alhambra, Calif.

Reliable Linen Service
3200 N. Figueroa
Los Angeles, Calif.

Republic Steel Corp.
Berger Div., E
E. 69th St.
Canton 5, Ohio

Research Appliance Co.
P. O. Box 307
Route 8 at Craighead Rd.
Allison Park, Pa.

Research Products Corp.
1015 E. Washington Ave.
Madison 1, Wis.

Rett Electronics, Inc.
21535 Groesbeck Hwy.
Warren, Mich.

Royal Metal Mfg. Co.
1 Park Ave.
New York 16, N. Y.

Royco Instruments, Inc.
440 Olive St.
Palo Alto, Calif.

S

Sampson Scientific Co.
2830-36 W. Lake St.
Chicago, Ill.

Steelcase, Inc.
1120 36th St., S.E.
Grand Rapids, Mich.

Shane Uniform Co., Inc.
2015 W. Maryland
Evansville 7, Ind.

Shielding, Inc.
Box 33
Riverton, N. J.

Simonize Co.
2110 Indiana Ave.
Chicago, Ill.

Simpson Electric Co.
5200 W. Kinzie St.
Chicago 44, Ill.

Snow Filtration Co.
129 W. 4th St.
Cincinnati 2, Ohio

Sonic-Air Products, Inc.
1246 Birchwood Dr.
Sunnyvale, Calif.

Speco, Inc.
7308 Associate Ave.
Cleveland 9, Ohio

Spellman Engineering Corp.
732 Brookhaven Dr.
Orlando, Fla.

Spencer Turbine Co., The
486 New Park Ave.
Hartford 6, Conn.

Square D Co.
Industrial Controller Div.
4045 N. Richard St.
Milwaukee 12, Wis.

Squires Co., The C. E.
18502 Syracuse Ave.
Cleveland 10, Ohio

Standard Glove Co. of New Jersey, Inc.
109 Frelinghuysen Ave.
Newark 8, N. J.

Stanley Works, The
195 Lake St.
New Britain, Conn.

Staplex Co., The
Air Sampler Div.
777 Fifth Ave.
Brooklyn 32, N. Y.

Star Tex Mills Co.
Lockport, N. Y.

Stoddard Industries
3383 E. Layton Ave.
Cudahy, Wis.

Surface Combustion Div.
Midland-Ross Corp.
2375 Dorr St.
Toledo 1, Ohio

Switchcraft, Inc.
5555 N. Elston Ave.
Chicago, Ill.

Sylvania Electric Products, Inc.
48th St.
Wheeling, W. Va.

T

Taylor Instrument Co.
Olsen & Ames Sts.
Rochester 1, N. Y.

Technical Filter Co.
2719 S. Poplar Ave.
Chicago, Ill.

Thermotank, Inc.
11191 Lappin Ave.
Detroit 34, Mich.

Titus Mfg. Corp.
P. O. Box 810
Highway 20, West
Waterloo, Iowa

Tolerton Co., The
265 N. Freedom
Alliance, Ohio

Trane Co., The
La Crosse, Wis.

Trerice Co., H. O.
1420 W. Lafayette Blvd.
Detroit 16, Mich.

Trion, Inc.
1124 12th St.
McKees Rocks, Pa.

Tuttle & Bailey
Div. of Allied Thermal Corp.
215 Warren St.
New Britain, Conn.

Typhoon Air Conditioning Div.
Hupp Corp.
505 Carroll St.
Brooklyn 15, N. Y.

U

Ultrasonic Industries, Inc.
Ames Court, Engineers Hill
Plainview, Long Island, N. Y.

Union Carbide Development Co.
270 Park Ave.
New York, N. Y.

Union Industrial Equipment Corp.
40 Beech St.
Port Chester, N. Y.

Unistrut Products Co.
933 W. Washington Blvd.
Chicago 7, Ill.

United Electric Controls Co.
85 School St.
Watertown 72, Mass.

United Lighting & Ceiling Co.
2828 Ford St.
Oakland, Calif.

United Sheet Metal Co., Inc.
383 N. Cassady Ave.
Columbus 19, Ohio

United States Gauge Division
Sellersville, Pa.

United States Rubber Co.
1230 Ave. of Americas
New York 20, N. Y.

United States Stoneware Co., The
Tallmadge Ave.
Akron 9, Ohio

Universal Diffuser Corp.
155 Saw Mill River Rd.
Yonkers, N. Y.

Universal Dynamics Corp.
4200 Wheeler Ave.
Alexandria, Va.

V

Victor Gloves, Inc.
49 E. 21st St.
New York 10, N. Y.

Von Brand Filtering Recorders
Hopewell Junction, N. Y.

Vortox Co.
121 S. Indian Hill Blvd.
Claremont, Calif.

W

Waber Electronics, Inc.
Hancock & Somerset Sts.
Philadelphia 33, Pa.

Walton Laboratories, Inc.
1186 Grove St.
Irvington 11, N. J.

Westinghouse Electric Corp.
Air Conditioning Div.
P. O. Box 510
Staunton, Va.

Westinghouse Electric Corp.
Sturtevant Div.
Damon St.
Hyde Park 36, Mass.

Westinghouse Electric Corp.
X-Ray Dept.
2519 Wilkens Ave.
Baltimore 3, Md.

Westinghouse Lamp Div.
Westinghouse Electric Corp.
Bloomfield, N. J.

White Room Div.
Cement Enamel Development, Inc.
18636 Fitzpatrick Ave.
Detroit 28, Mich.

Worklon, Inc.
253 West 28th St.
New York, N. Y.

Worner Electronic Devices
121 N. Main St.
Rankin, Ill.

Worthington Corp.
Ampere Station
East Orange, N. J.

Y

York Corp.
Grantley Rd.
York, Pa.

Performance Characteristics . . .

Plastic Electrostatic Filters

by J. B. Blanton*

Editor's Note:
The March, 1961 issue of AIR ENGINEERING carried on page 37 a critique on plastic electrostatic filters prepared by the Air Filter Institute. We offered at the time the article appeared to publish a rebuttal by any qualified person. Mr. Blanton's article is presented as such a rebuttal. Statements made in this article are Mr. Blanton's conclusions on the subject of the efficacy of fiber filter media.

PLASTIC electrostatic filters are finding increased acceptance on the basis of performance. One national organization had extensive tests made of electrostatic filters on the job by an independent engineering firm. These tests showed that the plastic filter picked up 93 percent more dust by weight than did a well known glass fiber filter. A large chain reports that they are especially pleased because they have eliminated oil vapor and film from metal filters by switching to plastic filters. They show considerable reduction in operating costs in a locale of high humidity.

There are several methods of proving the presence of electrostatic energy. An electroscope is a simple device. For more detailed facts, a microscopic examination can be made. Dust pick-up on the strands of a plastic filter is quite different from the formations shown on the viscous impingement type. The plastic filter does not tend to bridge or clump in the corners. Dust is held to the strands (Fig. 2) in a position generally

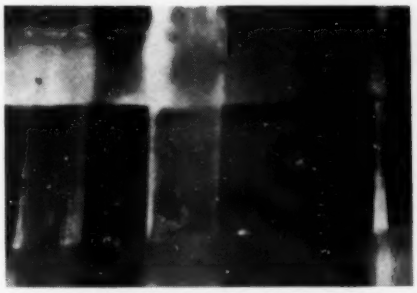


Fig. 1: Microscopic view of filter before use in average installation.

parallel to the direction of airflow thus allowing heavier loading with less build up of resistance. The characteristic three-shaped formations have been proved by photomicrographs.

Because of the lack of standards of evaluation of the many conflicting claims, the largest manufacturer of plastic filters suggests to industrial users that they try a few filters in their own installation and observe results before making the switch. Such trials have been so satisfactory that business is booming.

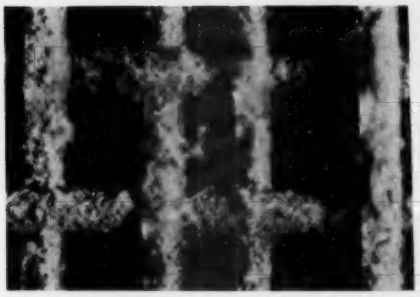


Fig. 2: Microscopic view of filter after use in average installation.

Besides proved performance, some of the factors that are contributing to the rapid growth of this new industry are reduced operating costs, the absence of price cutting and the fact that cheap foreign competition has not yet caught up to this advanced American technology. ▲▲

Mr. Blanton is president of the Permatron Corporation, is listed in Who's Who in commerce and industry classifications as a pioneer in the development of the plastic electrostatic filter.

1 ST
CHOICE
FOR
DUST FREE
PRODUCTION
We must admit we're stretching it a bit when we picture this unit in a desert dust storm. Actually, this is a stock dust-free enclosure of stainless steel, designed to be assembled with counter parts for production line industrial use and can easily function perfectly under such conditions.
We are a division of Kewaunee Manufacturing Co., specializing in engineering and production of highly technical equipment and apparatus for research and industry. Our experience and facilities qualify us to custom design and manufacture, or assemble from stock, any of the following types of enclosures: glove, vacuum and dry boxes; dust free enclosures; and controlled atmosphere systems.
For complete information, call or write
K·S·E
KEWAUNEE SCIENTIFIC EQUIPMENT ADRIAN, MICHIGAN
4055 Logan Street
[For more information circle #18 on page 61 reply cards]

NEW TYPE

Sole Cleaning Units for "White Rooms"

KLING KLEEN

No Time Wasted

A specially constructed pressure-sensitive material . . . the ultimate for removal of dirt or dust from soles and heels. Ideally suited for placement at entrances of any work area which requires freedom from dust. When material becomes soiled simply remove sheet as shown in illustration below. Under normal conditions each sheet can be walked across about 100 times.

10 Seconds for Removal of Soiled Sheet

- No Maintenance
- No Pails, Mops, Detergents
- No Washing
- No Shrinking
- No Danger of Heel Digging

Another Liberty Advancement in NAPPI Dust Control Equipment

For more information, write or phone

LIBERTY MACHINE CO.

598 Deming Road
Berlin, Conn.
Tel. VAlley 8-9555

[Circle #56 on page 61]

Precision Cooling

(Continued from page 41)

hermetic reciprocating compressors with multi step capacity control comprises the refrigeration for all Lab areas except the existing lab which has its own existing air conditioning system.

Complete cost of the lab including site excavation, building construction, plumbing, heating ventilation and air conditioning, fire protection and electrical work was approximately $450,000. ▲▲

CREDITS

For Bausch & Lomb, Inc. . . . Carl Day, vice president, manufacturing; Elmer Moon, Eng. and Maint. Div. Supt.; Samuel H. Fruscione, Glen Light, and Michael A. Pena, Plant Engineering Staff.

Architect . . . . Carl R. Traver, Rochester, N. Y.

General Contractor . . . . John B. Pike & Son, Inc., Rochester, N. Y.

Consulting Engineer . . . . John W. Furlow Engineers, Inc., Philadelphia.

EQUIPMENT

Packaged water chillers . . . . The Trane Company

Fan-Coil Units, Exhaust Fans . . . . Clarage Fan Company

Pumps . . . . Bell & Gossett Co.

HW and CW Coils . . . . Aerofin Corp.

Electric Reheater Elements . . . . Indeeco

Filters . . . . Farr Co.

Cooling Towers . . . . E. D. Goodfellow, Inc.

Pneumatic Controls . . . Johnson Service Co.

Electronic Controls . . . Taylor Instrument Co.

Ventilation for Liquid Transfer

(Continued from page 43)

through, hood enclosure of slot type ventilation as described in a previous article on ventilation of tanks, tubs and kettles.

Transfer of liquid by pump may be done in a closed system with little chance of exposure to employees. Special pumps such as submerged pumps or pumps with mechanical seals may be required in some applications to limit the possibility of leakage of extremely toxic or irritating liquids from the pump. In cases where pumps with packing glands must be used and leakage does occur, mechani-

ULTIMATE IN SHOE CLEANING *for* DUST-FREE LOCATIONS!!

MODEL 400A.

Complies with Technical manual standard Functional criteria for Design and operation of clean rooms.

NEW FEATURES

- ★ Elongated box to ensure cleaning back of heel on even the largest shoes.
- ★ Non-conductive plastic coated handle.
- ★ New design brush to assure ultimate in cleaning of the area at sole and heel juncture.
- ★ 90 CFM vacuum system utilizing over 96% retentivity microstatic filter.

GUARANTEED
EFFICIENT

For More Information Contact

LIBERTY MACHINE

P.O. Box 172
598 Deming Rd.
Berlin, Conn.
Tel. VAlley 8-9555

[Circle #58 on page 61]

cal ventilation and hoods may be used for the control of vapors from these pumps. In conjunction with the hoods, trays or pans should be utilized to contain the liquid that has leaked from the packing gland.

Packing Gland

Fig. 3 shows a hood enclosure for a packing gland which may be utilized. The hood is placed over the packing gland. A control volume of 100 cfm will usually provide satisfactory control. Flexible ducts may be used for ease of removal.

Complete Hood Enclosure

If the pump is relatively small, a complete hood enclosure may be employed. Fig. 4 shows the design of the hood enclosure for a pump. A control velocity of 100 fpm across the opening of the hood will usually provide the necessary control. For ease of removal for maintenance purposes the hood may be attached to the duct system with flexible ductwork. ▲▲

AIR SAMPLING & DUST CONTROL

We manufacture filter papers and non-woven synthetic and organic media with CFM ratings of 4.2 to 620

Contact us for detailed information

H&V

HOLLINGSWORTH & VOSS

East Walpole, Mass.
Tel.: MOntrose 8-0295

[Circle #52 on page 61]

Where people gather...CLEAN PURE AIR is VITAL

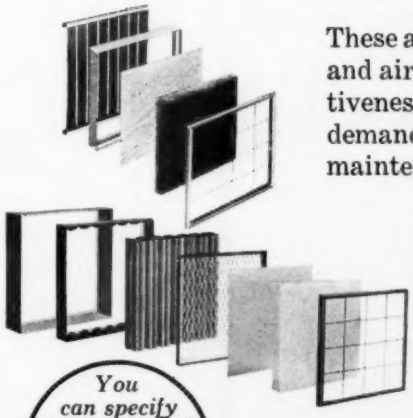
ARCHITECT: Heitschmidt and Thompson, AIR CONDITIONING CONTRACTOR: Air Conditioning Company, Inc. (Southern California), MECHANICAL ENGINEER: J. L. Hengstler

• At The Biltmore Hotel in Los Angeles, an atmosphere of clean, pure air is thoughtfully provided for guests and staff.

In the public areas, where it is necessary to permit entry of large amounts of vitiated outside air, combination replaceable media air filters and total detention type gas and vapor adsorbers by Burke are being used.

In the guest rooms, where 100% of the air is recirculated, combination replaceable media air filters and partial detention type gas and vapor adsorbers are in operation.

ROTOAire® CLEANS AND PURIFIES OVER A BILLION CUBIC FEET OF AIR DAILY IN THE BILTMORE HOTEL!



These are the advance design air filters and air purifiers that deliver the effectiveness, efficiency and dependability demanded by all modern building and maintenance programs.

They are readily adaptable to all new or existing installations.
They are available in a wide variety of sizes.
They may be operated at varying velocities and with various combinations of media.
The initial cost is low, but even more important . . . the maintenance cost is low.

You can specify ROTOAire® PRODUCTS *with confidence!*

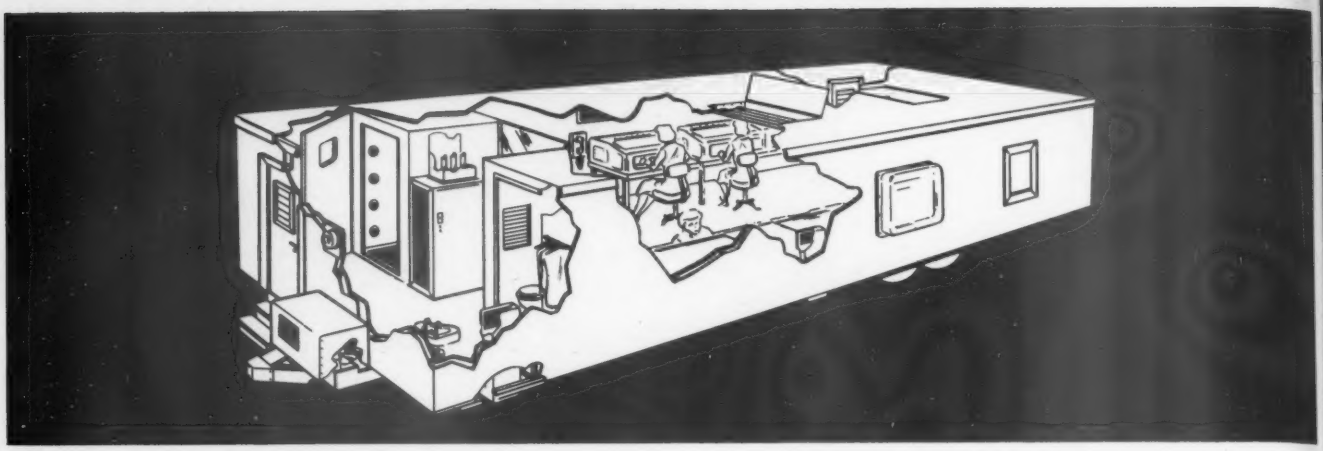
Write for Technical Data Bulletin and "Economic Analysis."

Selected Territories Available For Qualified Representatives

BURKE *and* COMPANY

2902 Hyde Park Blvd., Los Angeles 43, California

[For more information circle #20 on page 61 reply cards]



LOW COST PACKAGED MOBILE CLEAN ROOM

for critical assembly or packaging operations

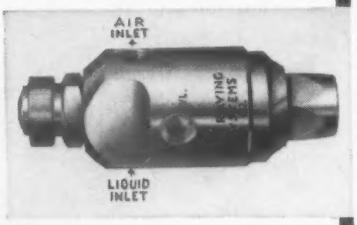
- 500 square feet of facilities
- complete with "absolute" filtrations
- humidity & temperature controlled air conditioning
- Air shower, toilet facilities, dressing room
- flush lighting with fire sprinklers ceiling mounted
- vinyl walls, flooring and ceiling
- filters and light bulbs changeable from exterior
- Interlock door permits continuous expansion
- Special facilities—shoe cleaners, dust counters, vacuum cleaners, sticky-mats, fume hoods, sterilhoods, etc., factory installed.
- Can be assembled complete ready for operation or knocked down ready for erection.

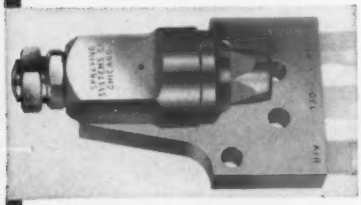
CAEMCO CLEAN ROOM DIV. Controlled Atmosphere Enclosures Mfg. Co., P.O. Box 897, Marianna Airbase, Marianna, Florida

[For more information circle #47 on page 61 reply cards]

pneumatic atomizing

SPRAY NOZZLES





for AUTOMATION

Spraying Systems offers a complete selection of automatic pneumatic atomizing nozzles for use where controlled intermittent spraying is required. In-built shut-off valve is air operated. Precision built for exact control of spray type and volume. Compact and easily installed. Write for Bulletins 114 & 116.

SPRAYING SYSTEMS CO. 3202 Randolph St. • Bellwood, Ill.

FOR EASIER SPRAY NOZZLE INSTALLATION in any type of system . . . see Catalog 24 for Spraying Systems Adjustable Joints . . . and Bulletin 93 for the NEW Spraying Systems Split-Eyelet Connectors.

[For more information circle #48 on page 61 reply cards]

Flexonics' Clean Room

(Continued from page 35)

paint, with a lighter coat of this material on balance of the floor area. This covering does not flake or chip. Gratings over depressed areas, and safety rails, are made of epoxy coated carbon steel.

Lighting

All lights are fluorescent and flush mounted, as shown in Fig. 4. Servicing is done from within the facility, through drop openings. Light intensity is about 100 foot candles at working height, with supplementary illumination supplied from portable equipment, as needed.

With this type of contamination control facilities described above, Flexonics can step-up service requirements for customers to meet the increasingly higher contamination control standards of tomorrow, without excessive cost for future alterations in facilities. ▲▲

CREDITS

Architect—*Ralph Stozel*

Consulting Engineer—*Patrick J. Carrado*

EQUIPMENT

Air Conditioning Compressor—*Carrier Air Conditioning Company*

Make-up Steam Coils—*Plate-Coil*

Hoods—*Flexonics Corporation*

Blowers—*American Blower Corporation and American Air Filter Co., Inc.*

Pre-Filters—*American Air Filter Co., Inc*
Super-Interception Filters—*American Air Filter Co., Inc.*
Controls—*Minneapolis-Honeywell Regulator Company*
Alarms—*Minneapolis-Honeywell Regulator Company*
Structural Members and Panels—*Unistrut Products Company*
Lights—*Wigdahl Electric Company*
Cooling Coils—*Carrier Air Conditioning Company*
Coveralls—*Angelica Uniform Company*
Central Vacuum Cleaner System—*Hoffman Machinery*
Head and Foot Covers—*Angelica Uniform Company*
Epoxy Paint—*Mid-Western Coating*

Questions and *Answers*

(Continued from page 29)

ducts for disinfecting purposes; high kill efficiencies have been reported.[11]

Chemicals and chemical sprays have been reported using such materials as sodium hypochlorite, propylene glycol and certain complex organic salts[12] for the reduction of bacteria in air. Lithium chloride solution sprayed on the heating and cooling coils of an air conditioning unit has been shown to kill numerous pathogenic organisms.

Capillary air washers with suitable glass fiber packing and sterilization of the pump water by ultra-violet radiation or by addition of a non-volatile bactericidal agent has been reported to be effective in removing bacteria.

REFERENCES

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(2) Laboratory Hood Ventilation Design. *Michigan Occupational Health,* Vol. 4, No. 4, 1959, Michigan Department of Health, Lansing, Michigan.

(3) Fredette, V. Bacteriological Efficiency of Air Conditioning Systems In Operating-Rooms. *Canadian Journal of Surgery,* April, 1958, pp. 226-229.

(4) Silverman, L. and Dennis, R. Electrostatic Precipitator. *Air Conditioning, Heating, and Ventilating,* December, 1956.

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(6) First, M. W., Sc.D. Controlling Airborne Bacteria . . . How Well Can It Be Done. Part II. AIR ENGINEERING, May, 1960, p. 43.

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(8) Decker, H. M. et. al. Removal of Bacteria and Bacteriophage From The Air By Electrostatic Precipitators and Spun Glass Filter Pads. *Heating, Piping and Air Conditioning,* October, 1951, pp. 125-129.

(9) Lurie, M. B. and Abramson, S. Reproduction of Human Ulcerative Pulmonary Tuberculosis in Rabbits by Quantitative Natural Airborne Contagion. *Proceedings of the Society for Experimental Biology and Medicine,* Vol. 9, December, 1948, p. 531.

(10) A Laboratory Building for Study of Highly Infectious Diseases. *Engineering News-Record,* Vol. 139, October 2, 1947, pp. 460-463.

(11) Hoffman, J. C., Air Sanitation With Ultraviolet Light, Part II, AIR ENGINEERING, November, 1960, pp. 43-45.

(12) Hudson, P. A., M.D., et. al. A System For Control of Pathogenic Bacteria in Hospital Envinonment. *Medical Annals of the District of Columbia,* Vol. XXVIII, No. 2, February, 1959.

AIR DECONTAMINATION IMPORTANT STEP IN ASEPTIC PROCEDURES FOR "WHITE ROOMS"

*

Effectiveness, safety and ease of installation keynote the scientific (functional) designs of new Letheray germicidal fixtures. They represent the culmination of 25 years scientific development and manufacturing experience in the field of air sanitation equipment by Hanovia, the name synonymous with ultraviolet for more than 50 years.

*

Protects humans, products and laboratory animals against air-borne infectious diseases and contamination.

*

WALL MODEL: Indirect continuous irradiation.

UNIVERSAL MODEL: Direct or focused irradiation. Continuous or intermittent operation.

*

MOBILE UNITS: Hospital Model, 65 Watts; Industrial Model, 1200 Watts.

AIR DUCT STERILIZERS: High intensity 1200 Watt Sterilizers for exhaust and air conditioning systems.

*

SAFEGUARDS Sterile Processing, Packaging and Research Areas; Cubicles; Air-locks; Hoods; Animal Rooms; Hospital Operating Rooms, Isolation and Autopsy Rooms, Wards and Clinics.

*

Other famous Hanovia Ultraviolet products include: Black Light and Analytic Lamps, Water Sterilizers, Photochemical Equipment (laboratory and commercial), Light Sources for Instrumentation.

*

Write for information on ultraviolet lamps and related equipment.

Special Products Dept.

★ ENGELHARD HANOVIA, INC ★

HANOVIA

LAMP DIVISION

100 Chestnut Street, Newark, New Jersey

[For more information circle #49 on page 61 reply cards]

New Literature

Heatless Dryers, Purifying Systems, and Miniature Compressors

Applied Pneumatics, Inc. announces a new 4-page catalog on Heatless Dryers, Purifying Systems, and Miniature Compressors.

The literature describes dryers, hydrogenous absorbers, and central systems for producing clean, pure, extremely low dewpoint air and other gases for Military, Industrial, and Laboratory uses. Typical applications include cooling electronic devices, radar pressurization, microwave transmission lines, and dry box purging.

These products also can be used for TV transmission lines, cable pressurization, cavities, waveguides, and duplexers, in addition to co-axial cable, and instrument air drying.

Circle #131 on page 61.

Polypore Membrane Filter

The Gelman Instrument Company has just published an informative 24-page catalog dealing with their *Polypore* membrane filter. The catalog describes the unique advantages and applications of this versatile filter in:

Air Sampling: Air sampling and cleaning, aerosol sampling, radioactive aerosols, tracer studies, superpure air and gas, air cleaning efficiency tests, white room tests, aerosol identification.

Industry: Electronics, foods and beverages, process industry, nuclear industry, precision manufacturing-missiles, ultrasonic cleaning.

Chemistry: Spectroscopy, radiochemistry, spot tests, chemical analysis, crystal growth.

Biomedicine: Bacteriology, biochemistry.

Circle #132 on page 61.

Automatic Control of Heating and Air Conditioning

Here is a 390-page practical, detailed account of the fundamentals, selection, and application of automatic control as it applies to heating, ventilating, refrigerating, and air conditioning. It defines and explains countless problems of automatic control, and provides principles and techniques for solving them. By John E. Haines, vice president, Minneapolis - Honeywell Regulator Company.

Circle #133 on page 61.

Multizone Units

A new 64-page bulletin on multizone air conditioning units has been published by Marlo Coil Co., St. Louis. These central station units supply heated or cooled air simultaneously and independently to several zones. They are available in 34 sizes, horizontal or vertical arrangement.

Circle #134 on page 61.

(Please turn to page 63)

SAMPLE AIR FASTER, MORE ACCURATELY, PORTABLY

Accurate to 1/100 micron!

INDISPENSABLE for series or unit air sampling – indoors or out. Portable, yet stands up to heaviest usage. Weighs only 10 lbs. Comes equipped with standard 4" filter holder. Special adapters available for 6" x 9"; 8" x 10"; 12" x 12" and others.

Staplex Air Samplers are widely used to solve the many diverse, exacting needs of leading industries. Also for industrial hygiene and health departments, nuclear and missile fields; manufacture and processing of beryllium products, radioactive materials and all other industrial dusts and air pollutants.

Let us help you solve your air sampling problems as we have for thousands of users. Send for details.

THE STAPLEX COMPANY

780 FIFTH AVENUE • BROOKLYN 32, N. Y.

World's Largest Manufacturer of High Volume Air Samplers

[For more information circle #40 on page 61 reply cards]

"IS WHITE ROOM DUST YOUR PROBLEM?"

If so the *CLEAN TREAD MAT* is the answer to your question. The Mat when placed in front of the entrance to the White Room Area is the perfect trap for walk in dust. Easy to clean and maintain.

THE MIRACLE MAT THAT PICKS UP EVERY TRACE OF DUST AND DIRT *INSTANTLY.*

CLEAN TREAD DIVISION

of

M. P. & C. CORP.

157 Regent Street — Cambridge 40, Mass.

TRowbridge 6-6122

[For more information circle #36 on page 61]

New Literature

(Continued from page 60)

Metal-On Insulation System

The Metal-On Insulation System, Johns-Manville's integrated pipe insulation that combines metal jacketing, high temperature calcium silicate insulation, and moisture barrier in one factory fabricated unit, is described in brochure, IN-217A.

The brochure describes and illustrates the Metal-On System and how it is installed in a single, cost-cutting operation, and enumerates its advantages. Specific installations, both indoors and outdoors, are illustrated in a series of photos. Detailed description of the various components of the system are given, including the new Miter-Seals, which allow use of mitered sections, cut on the job from straight lengths, for covering elbows, tube turns, sweeps.

Circle #135 on page 61.

Case Histories On Coolant Filtration

The Filtration Division of Hoffman Industries, Inc., has prepared several case histories showing how leading companies overcome metal-working production problems caused by contaminated coolant.

The case histories show that maintenance of clean coolant eliminates hidden costs such as shorter tool and wheel life, down time for wheel dressing, tool sharpening and sump tank cleaning. Benefits include higher speeds, faster feeds, improved finishes, fewer rejects, longer useful life for coolants, more sustained tolerances, fewer stoppages and adjustments in the machines, considerable reduction in scrap loss, lower labor and material costs. A 25 to 50% savings in grinding wheels and individual machine tools are reported.

Circle #136 on page 61.

Ultrasonic Cleaning

A new ultrasonic cleaning principle incorporated in the Pall-Cavitron HIPS Ultrasonic Cleaner is discussed in an article entitled "Focused Energy Cleans Filters," available from Aircraft Porous Media, Inc., Glen Cove, New York.

The article describes how focused ultrasonic energy, combined with the test facilities in the HIPS unit, reliably cleans and tests fine wire mesh filter elements used in aircraft, missiles and ground support equipment as well as valves.

Circle #137 on page 61.

Gas-Fired Duct Heater Assemblies

New gas-fired duct heater assemblies for complete or supplemental heating of industrial and commercial buildings, aircraft hangars, sports arenas, and other large buildings, are described in a new illustrated 4-page bulletin available from L. J. Wing Mfg. Co.

Circle #138 on page 61.

(Please turn to page 64)

Cleanline® WORK TABLES

Control of dust, dirt and contamination on table tops is vitally important since it is here that critical products are assembled, tested and inspected.

All exposed work surfaces of Cleanline Work Tables are Formica or Stainless Steel. Pedestal bases are chrome plated. There are no legs or auxiliary supports to interfere with cleaning the floor.

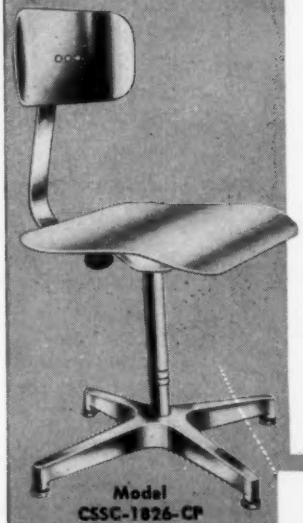
Standard lengths are 4, 6 and 8 ft. with built-in electrical outlets if desired. Other lengths, widths and services can be provided.

For complete specifications and prices write for Bulletin CWT761.

Controlled Environment, Inc.
915 Great Plain Avenue • Needham 92, Mass.

[For more information circle #37 on page 61 reply cards]

SPECIAL CHAIRS FOR WHITE ROOMS AND DUST FREE AREAS



- All Enclosed Mechanism
- No Oil or Grease
- All Chrome Plate Finish
- Easily Cleaned
- 12 Ga. All-Steel Seat; 14" x 15⅜"— Waterfall Form. Sand Blast Surface. Adjusts 18" to 26".
- 12 Ga. Steel Backrest; 6" x 13¾"—with tempered steel backrest support. 6 inch horizontal adjustment. Backrest folds down to make easy cleaning.
- Cast Iron Base; 20-inch spread. 1⅛" steel glides.

Other White Room chairs with lacquered plywood seat and backrest.

FREE TRIAL Use an AJUSTRITE chair for 30 days without obligation. Prove to yourself the many advantages AJUSTRITE offers in comfort, utility and economy. Write today—we'll do the rest.

10 YEAR GUARANTEE

32 Models for Factories • Schools • Laboratories • Hospitals • Offices

AJUSTRITE CHAIRS AND STOOLS

AJUSTO EQUIPMENT CO.
Bowling Green, Ohio

[For more information circle #38 on page 61 reply cards]

Do you have a
White Room or
Clean Room problem?

Contact

Leitch-Huard Corp.

Commercial Street

Manchester, N. H.

NAtional 2-3727

[Circle #51 on page 61]

New Literature

(Continued from preceding page)

Pneumatic Temperature Transmitter

Described in Bulletin 13-17C is the Type 12A Pneumatic Temperature Transmitter developed by The Foxboro Company. Features of transmitter design are emphasized: compact construction; force-balance operation; and — to sustain measurement accuracy—automatic compensation for ambient temperature and pressure changes.

Circle #139 on page 61.

Sirocco Fan Bulletin

A new 48-page, 8½ x 11 two-color illustrated catalog (Bulletin No. A-1401) describing the American-Standard line of Sirocco fans, Series 81, Class I and II, is now available from American-Standard Industrial Division.

The new bulletin discusses the Sirocco fan in terms of its construction features and operating characteristics. Drive arrangements, control methods, and types of drive are described and illustrated. Specific component features such as bearings and sound-absorbing bases are also discussed.

Capacity tables are provided for the full line of 15 sizes, single-inlet single-width design and 12 sizes, double-inlet double-width design.

Circle #140 on page 61.

Electric Furnace Fume Control

How to control electric furnace fumes is explained in new six-page Bulletin No. 924 by Pangborn Corporation.

Detailed photographs and sketches show how Pangborn's new exhaust hood, combined with a synthetic-fabric dust collector, completely eliminates electric furnace smoke and fumes. Factors enabling this system to operate efficiently even during oxygen lancing are also discussed.

Circle #141 on page 61.

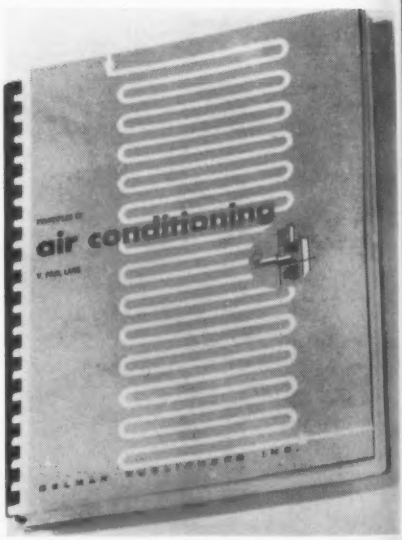
Air Measuring Instruments

A new comprehensive bulletin on air flow systems featuring the Alnor Velometer and accessories has just been published by the Alnor Instrument Company, division of Illinois Testing Laboratories, Inc. Bulletin No. 2448 contains information on air flow measurement that is valuable to the heating and air conditioning engineer and contractor. Ask for Bulletin.

Circle #142 on page 61.

Air Conditioning Fundamentals

A new textbook on air conditioning designed primarily for use in vocational schools and technical colleges has recently been written by Paul Lang, technical editor in the application engineering department of Carrier Air Conditioning Company.



Entitled "Principles of Air Conditioning," book describes in simple terms the "how to" and "why do" of technical air conditioning problems encountered by technicians and servicemen. Included in the 327 pages are more than 500 illustrations and tables related to air conditioning equipment.

Circle #143 on page 61.

To receive information on any of the New Products, circle the item reference number on the postage-free reply cards on page 61, Communications Center.

New PRODUCTS

Dust-Free Cabinet

Purpose: For clean rooms and other manufacturing and assembly areas where special provision for environmental control not provided.

Features: Cambridge Model B Specialaire dust-free cabinet has a high efficiency "packaged filter unit" which can be quickly removed for cleaning or replacement with minimum down-time and contamination.

Work chamber is illuminated, provides controlled environment for assembly, test, research and repair of miniature products.

Packaged filter unit has two-speed blower, two filters attached to rear of cabinet. Air passes through permanent washable type filter, then through high efficiency Aerosolve® filter. Filters remove 99.25% of particles of 0.5 to 1.0 micron. Efficiency is 100% over 2 microns. Filter life of Aerosolve® varies from 1200 to 10,000 hours. Blower gives 150 cfm or 130 cfm at low speed.

Front hinged panel is mounted at 30° angle to reduce reflection. Work chamber is 36″ by 28″ deep by 18″ high.

Circle #71 on page 61.

Flooded Bed Scrubber

Purpose: For removing toxic and corrosive contaminants from gases.

Features: John Wood Flooded Bed Scrubber available in rated capacities from 200 to 5,000 cfm and larger in combination.

Two packed beds, each flooded with a scrubbing liquid, sustain intimate and continuous contact between the contaminated gas and the scrubbing medium. Scrubbing action at the contact area is activated by the nature and energetics of the surfaces.

Efficiencies above 90% are reported in removal of NO, NO_2, hydrochloric, nitric and sulphuric acid vapors.

Circle #72 on page 61.

Industrial Dehumidifier

Purpose: For industrial humidity control and processing.

Features: Universal Dynamics Corp.'s model A500 is a "packaged" adsorption dehumidifier with new high capacity adsorption and reactivation systems and efficient high flow-low flow air transfer valves. Handles 3000 cfm and removes up to 75 lbs of water hourly.

The A500 features "plug-in" installation and uniquely clean design. Either electrical, steam or gas reactivation is available. Variations of this model are also being offered for high temperature dehumidification, laboratory dewpoints of minus 100°F (less than 0.1% r.h. at 40°F), drying of temperature-sensitive products, and pressurizing systems with bone dry air and gases.

Circle #73 on page 61.

Smokeless Incinerators

Features: New grate improvements in Goder "Space-Saver" incinerators provide non-clogging operation and permit replacement of internal components without breaking down and restoring brickwork. Maintenance is simplified by means of automatic charging which, assures clog-free operation.

Circle #74 on page 61.

Roof Exhauster

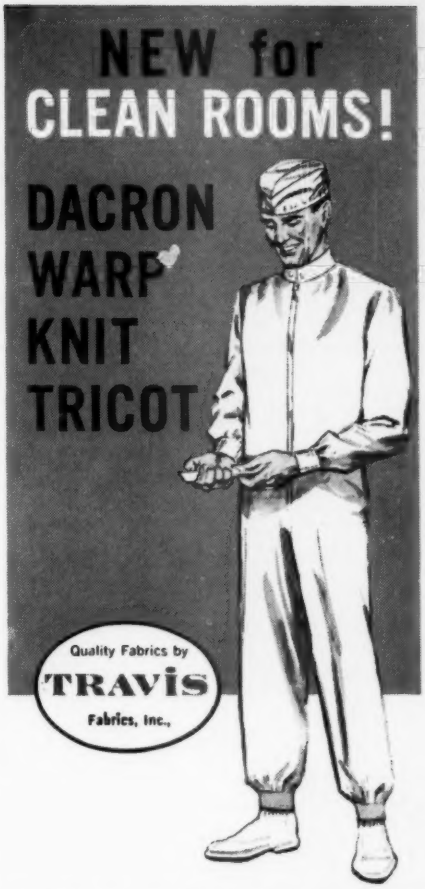
Purpose: Industrial ventilation.

Features: Penn Ventilator low silhouette exhauster is cased in attractive, compact extruded aluminum louver housing. Storm proven louver blades give the Linea exhausts an unbroken horizontal sweep that blends with and compliments natural building lines.

Available as a centrifugal roof exhauster, or provided with a propeller blade, the Linea is complimentary in appearance and design for all ventilator work where a low, clean attractive housing is required.

Circle #75 on page 61.

(Please turn to following page)



Here is an entirely different fabric of 60% Dacron and 40% Nylon, now introduced in industrial apparel specifically for **CLEAN ROOMS. Lint-Free Tricot** is lightweight, yet opaque... offers greater comfort because this unique fabric actually permits the garment to breathe. Unusual serviceability too! Will not ravel if torn or snagged. Special wrinkle-resistant finish retains its shape better, looks neat longer.

Look for new fabrics, new styles, new colors from Worklon, leader in the manufacture of special purpose work clothing. Choose from America's largest selection of lint-free, static-free and acid-resistant industrial apparel ...all illustrated in Worklon's new 1961 Fall Catalog.

Write today for your copy.

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[Circle #43 on page 61]

New PRODUCTS

(Continued from preceding page)

Finned Tube Heaters

Purpose: General building heating.

Features: Modine finned tube heating equipment has upper channels or back plates in 8-ft. lengths, brace assemblies. Hangers and heating elements of 50 fins/ft. are carried in stock for advance shipments with enclosures shipped later if desired. Elements with 40 and 32 fins/ft. available on order.

Rolled edges, welded interlock channels eliminate need for butt trims and screws. Lengths vary from 2 to 8 ft. in 6-in. increments. Heights from 12½ in. to 24 in.

Circle #76 on page 61.

Low Flow Control Valves

Purpose: Regulating flow of small streams of air, water, steam or chemical solutions, in the glass, chemical, distilling, drug, paint, paper plastics, rubber, soap, confectionery, air conditioning and refrigeration, heating, oil textile and electroplating industries.

Features: The new 1400 Series valves include a low-cost, lightweight diaphragm-actuated model, a high-performance diaphragm model, an ultra-low-flow model and two models having electric actuators designed by Minneapolis-Honeywell.

The valves are available in three body sizes (½, ¾ and 1-in.) with a wide selection of reduced inner ports to Cv's from .025 to 11 and a full range of materials and body ratings with both screwed and flanged connections.

Circle #77 on page 61.

Unit Ventilator Controls

Purpose: For automatic temperature control of all air conditioning, damper controlled type classroom unit ventilators.

Features: Control simplification achieved by use of motor operator-integral thermostat combinations, plug-in control and power wiring, unit mounted controls. Barber-Colman Bulletin F-10151-1 has full details.

Circle #78 on page 61.

Low-Velocity Acoustic Terminal

Purpose: Individual room control in dual-duct air distribution systems.

Features: "Pinpoint" temperature control for specific rooms, perfect blending of the hot and cold air for discharge to individual space areas, attenuation of self-generated as well as duct-carried noise, manual volume adjustment and choice of operation by either pneumatic or electric temperature controls.

Carnes offer two ceiling models —bottom and end discharge, in 5 sizes—and two window/perimeter models—top and front discharge, in 2 sizes.

Circle #79 on page 61.

Electronic Air Cleaner

Purpose: For use in inaccessible areas, with air handling units.

Features: Completely self-contained American Air Filter Company, Inc. high velocity electrostatic precipitator, Type HVSC Electro-Cell unit is complete with front and back duct connections, drain pan, pre-assembled washing and oiling mechanism. Can be floor or ceiling mounted. Range of 24 sizes from 1000 to 25,000 cfm. Automatic maintenance washing schedules can be varied for each job. Collection efficiency said to be 95% on normal atmospheric dust.

Circle #80 on page 61.

Condensing Units

Purpose: For air conditioning.

Features: Btuh capacity closely approaching water-cooled units of the same horsepower. Lennox HSA2-1103 air cooled condensing unit has 11 tons nominal cooling capacity.

Employs large condenser air volume and special coil circuiting to gain maximum capacity. Coil circuiting provides a "sub-cooling" benefit which delivers liquid refrigerant to evaporator up to 20° cooler than the evaporating temperature.

Circle #81 on page 61.

Compact Centrifugal Roof Ventilator

Purpose: General industrial ventilation.

Features: Western Engineering & Mfg. Co., "Centridyne," has aerodynamically designed extruded aluminum discharge vanes, straight-line styling and low compact shape engineered to harmonize with new linear design concept of modern architecture. Centridyne also features quietness of operation, non-overloading horsepower and a stable pressure curve.

Models range from ⅛ to 5 hp with wheel diameters from .990 up to 3,000 ft. Heights range as low as 11½-in.

Circle #82 on page 61.

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, JULY 2, 1946, AND JUNE 11, 1960 (74 STAT. 208) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF

Air Engineering published monthly at Detroit Michigan for October 1, 1961.

1. The names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Business News Publishing Company, Detroit, Michigan.

Editor, Eugene A. Sloane, Birmingham, Michigan.

Managing editor, Eugene A. Sloane, Birmingham, Michigan.

Business manager, Edward L. Henderson, Birmingham, Michigan.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.)

Business News Publishing Company, Detroit, Michigan.

Helen C. Henderson, Birmingham, Michigan.
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Phil B. Redeker, Detroit, Michigan.
Robert M. Price, Hillsdale, New Jersey.
C. Dale Mericle, Traverse City, Michigan.
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Edward L. Henderson, Birmingham, Michigan.
John O. Sweet, Detroit, Michigan.
P. Allen Schildhammer, Grosse Pointe, Michigan.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)

None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required by the act of June 11, 1960 to be included in all statements regardless of frequency of issue.)

6,309.

Edward L. Henderson,
Business Manager

Sworn to and subscribed before me this 2nd day of October, 1961.

[SEAL] Terry Kuhn Treiber
Notary Public, Wayne County, Michigan
(My commission expires December 31, 1963)

Finned Tube Radiation

Purpose: General building steam or hot water heating.

Features: Curved outlet cabinet, supply and return pipe hanger which can be mounted to conceal piping at different levels within the Trane Wall-Fin cabinet. Will accommodate 1-in. copper, 1¼-in. copper and 1¼-in. IPS pipe.

Mullion channels permit easier installation on panel or curtain walls.

The new curved outlet cabinet brings the Wall-Fin cabinet designs to four, including sloping outlet, front outlet and top outlet cabinets, in 4 and 5¼-in.-deep models and three standard cabinet heights.

Circle #83 on page 61.

Fall-Out Shelter Blower

Purpose: For hand operation.

Features: According to Cincinnati Fan & Ventilator Co., corrosion proof hand operated blower provides 185 cfm at comfortable rate of turn of 80 turns per minute. Available with or without auxiliary electric blower for line or electric power.

Circle #84 on page 61.

Infrared Heating Panels, Ovens

Purpose: For application in process heating.

Features: Fannon quartz infrared elements are available in 22, 46 and 70 in. over-all lengths with wattage ratings from 500 to 1500 watts for 115 volt elements and 500 to 3500 watts for 230 volt elements. Special size elements are available upon request. At normal line voltage, Fannon quartz infrared elements operate at approximately 1600 F, with peak emission at 3-3.5 microns, the far infrared range readily absorbed by most materials.

Circle #85 on page 61.

Packaged "Clean Room"

Purpose: For testing, assembly, repair and packaging of contamination-sensitive equipment under regidly controlled conditions of temperature, humidity and contamination.

Features: A new packaged environment by Moore & Hanks Co. provides a super-clean room that may be either stationary or portable, on a pre-engineered basis. Claimed to cost less than converting existing buildings, they will be more efficient. Temperature control to ±½°F, humidity to ±2% RH, dust to 0.5 microns. Structure can be expanded.

Circle #86 on page 61.

Industrial Space Heater

Purpose: Large volume factory heating.

Features: Peak output of 3,000,000 Btu is capacity of new Dravo Corporation's forced air industrial space heater. Counterflo Model 300 generates a maximum air flow of 38,000 cfm.

Unit is available with burners for gas, light or heavy oil, or combination gas and light oil. May be installed upright on the floor or raised above the floor level, or suspended horizontally or inverted.

Circle #87 on page 61.

Gas-Fired Unit Heaters

Purpose: General use where extreme quietness of operation is desired.

Features: A new line of American-Standard Series NB gas-fired unit heaters are equipped with centrifugal blowers said to have unusually low operating noise level.

Units can be remotely located with a run of duct to the heated space. They are available in 8 basic sizes with heating capacities from 50,000 to 250,000 Btu per hour input.

Circle #88 on page 61.

Refrigerant Desiccant

Purpose: For refrigeration service.

Features: Over ten times less R-22 decomposition than the original grade 4A Molecular Sieve, according to Linde Company. Has three times greater resistance to attrition, twice the crush strength and 10% higher bulk density.

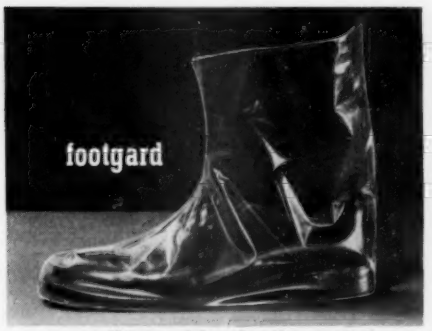
Circle #89 on page 61.

disposable plastic work gloves

Used for some time by laboratories and hospitals where disposability, maximum dexterity and sensitivity, as well as cleanliness, are **all important,** HANDGARDS and FOOTGARDS have suddenly been **discovered** by White Rooms in research centers, missiles, electronics, manufacturing plants, etc.

handgards combine low cost (just pennies apiece) with wonderful dexterity and fingertip sensitivity, allowing exacting work to be done by gloved hands. Of utmost importance in many white room situations is the protection afforded the product from dirt and moisture on the hands. Conveniently laminated in rolls of 100 on white tissue, Handgards are always fresh and clean. Also available in flat box of 100.

A MODERN CONCEPT IN WORK GLOVES AND BOOTS FOR WHITE ROOMS



disposable plastic work boots

footgards save money because they do not require special washing, handling and storage. Slip on a Footgard when you enter the dust-free area—throw it away when you leave. Footgards are laminated on rolls of clean white tissue —50 and 100 per roll.

Handgards and Footgards are available from laboratory, surgical, safety and glove supply houses.

plasticsmith, inc.
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Sales Office: 125 Old Orchard Arcade, Skokie, Illinois

[For more information circle #50 on page 61 reply cards]

(Continued from page 7)

Our job, as air engineers, is to keep abreast of new ways of providing critical climates so urgently needed by the products of the space age, because these will be the same climates needed by many a consumer product.

It's a sad commentary on our technological progress, but it does seem as though the urgencies of war or war prevention, give rise to a great many developments that would otherwise have been delayed into finding their way into civilian life for a decade or more.

The ceramics of nose cones have furnace lining possibilities, for instance. World War II radar helps prevent air tragedies today. Fission-created radioactive isotopes treat cancer, find new ways to make metal products last longer.

Gyros for missiles also guide uranium fueled subs under Arctic ice, will ultimately guide civilian ships and planes across unmarked reaches of sea and sky far more accurately than present day navigation guides.

Space age products use new techniques of micro-micro miniaturization, where a millionth of an inch tolerance is standard, a tenth of a millionth of an inch tolerance or greater is high precision.

These new standards need new, more precise climates free of all dust, even bacteria.

These new types of climates, in turn, should find increasing use in civilian life from cheese plants to hospitals, to make life longer and better. ▲▲

Eugene A. Sloane

Editor

Meetings

28th Exposition of Chemical Industries, *New York Coliseum, New York City, Nov. 27-Dec. 1, 1961.*

Public Health Service, Medical and Biological Aspects of Air Pollution, 1-week training course, *Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, December 11-15, 1961.*

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Incorporated, semi-annual meeting, *Chase-Park Plaza Hotel, St. Louis, Missouri, January 28-31, 1962.*

Air-Conditioning and Refrigeration Wholesalers, annual convention, *Los Angeles, California, February 9-11, 1962.*

12th Exposition of the Air Conditioning, Heating, and Refrigeration Industry, *Great Western Exhibit Center, Los Angeles, California, February 12-15, 1962.*

National Electrical Manufacturers Association's Electric Comfort Heating Equipment Section, exposition and symposium, *Sherman Hotel, Chicago, Illinois, March 19-21, 1962.*

National Association of Corrosion Engineers, annual conference and corrosion show, *Municipal Auditorium, Kansas City, Missouri, March 19-23, 1962.*

Western Space Age Industries and Engineering Exposition and Conferences, *Cow Palace, San Francisco, California, April 25-29, 1962.*

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OUTSTANDING OPPORTUNITY FOR DUST COLLECTOR SALESMAN

This job leads into manager of department. Well known highly rated (AAA-1) manufacturer of air handling equipment soon to enter gas cleaning field with complete line of dust and fume collectors needs experienced collector salesman to work directly under Division Manager. This man will be nucleus of the field sales force. Prefer man 25 to 30. Relocate to Central Ohio main plant at our expense. Liberal salary and benefits. Excellent growth opportunity in near future!

***write* BOX AE-11611, Air Engineering**

Use the Communications Center, page 61, to receive more information about any product advertised, any new literature or new product described. Circle the number on the postage-free card that refers to the item of your interest, add your name and address and mail.

To comment, criticize or make suggestions about any feature article in this issue, use the postage-free Editorial comment card.

IS DUST YOUR PROBLEM?

The MIRACLE MAT is your answer. This *mechanical* floor mat guards against walk-in dust and dirt . . . can be installed flush or over-the-floor . . . and is completely automatic!

Time-tested MIRACLE MAT meets rugged specifications of clean rooms across the nation.

Write to U. S. PATENT
PROGRESSIVE ENGINEERING CO.
HOLLAND, MICHIGAN

[For more information circle #39 on page 61 reply cards]

Information you need to get cleaner air at lower cost

Farr Company offers a complete line of air filters ranging from economy types up to those with the highest available efficiencies . . . Be sure you have the facts on the Farr line before you make your next air filter decision . . . To get this information, just mail the coupon below.

Please mail me literature on the following:

- ☐ Farr HP Filters (High performance disposable)
- ☐ Farr Roll-Kleen V-7 (Vertical roll type)
- ☐ Farr Roll-Kleen H-5 (Horizontal roll type)
- ☐ Farr Complete Line

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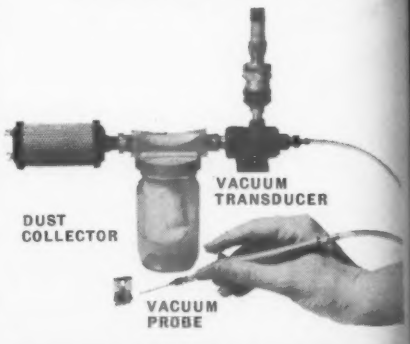

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The BAZOOKA Vacuum Probe with appropriate plastic tip, as small as .011" I.D., vacuums hard to reach areas that cannot be cleaned with compressed air. With the Vacuum Transducer, dust, lint, fuzz, and other foreign matter are controlled and collected.

Assemble and vacuum clean small semiconductor or electronic components, at the same time, with the BAZOOKA Vacuum Probe.

RECOMMENDATIONS GIVEN for your assembly or vacuum cleaning problems.

Write for FREE Vacuum Probe, Tip and Transducer Bulletins.

AIR-VAC ENGINEERING COMPANY, INC.
100 GULF ST., MILFORD, CONN. TRinity 4-2581

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